datron
ELECTRONICS LIMITED

SERVICING MANUAL
for
DATRON MODEL 1051
DIGITAL VOLTMETER

HURRICANE WAY
NORWICH AIRPORT INDUSTRIAL ESTATE NORWICH NR6 6JB ENGLAND

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SECTION 1

TECHNICAL DESCRIPTION

1.1 GENERAL

The internal circuits of the 1051 are divided between two printed circuit boards, in the basic machine. The first printed board (Schematic No. 430019) is the DC isolator board and includes the preamplifier, scaling circuits, bootstrapped supplies, and range logic. The second board (Schematic No. 430026) is concerned with Analogue to Digital conversion and produces the BCD output together with drive for the displays. The regulated power supply components are also mounted on this board. When AC and Ω are specified these are incorporated on two separate boards plugging into the main isolator board.

For the purpose of explanation boards will be described separately and each board further sub-divided according to the various functions involved.

1.2 DC ISOLATOR BOARD (Assembly Drawing No. 400087)

This is split in three distinct sections: isolator, range encoding/decoding, and range logic.

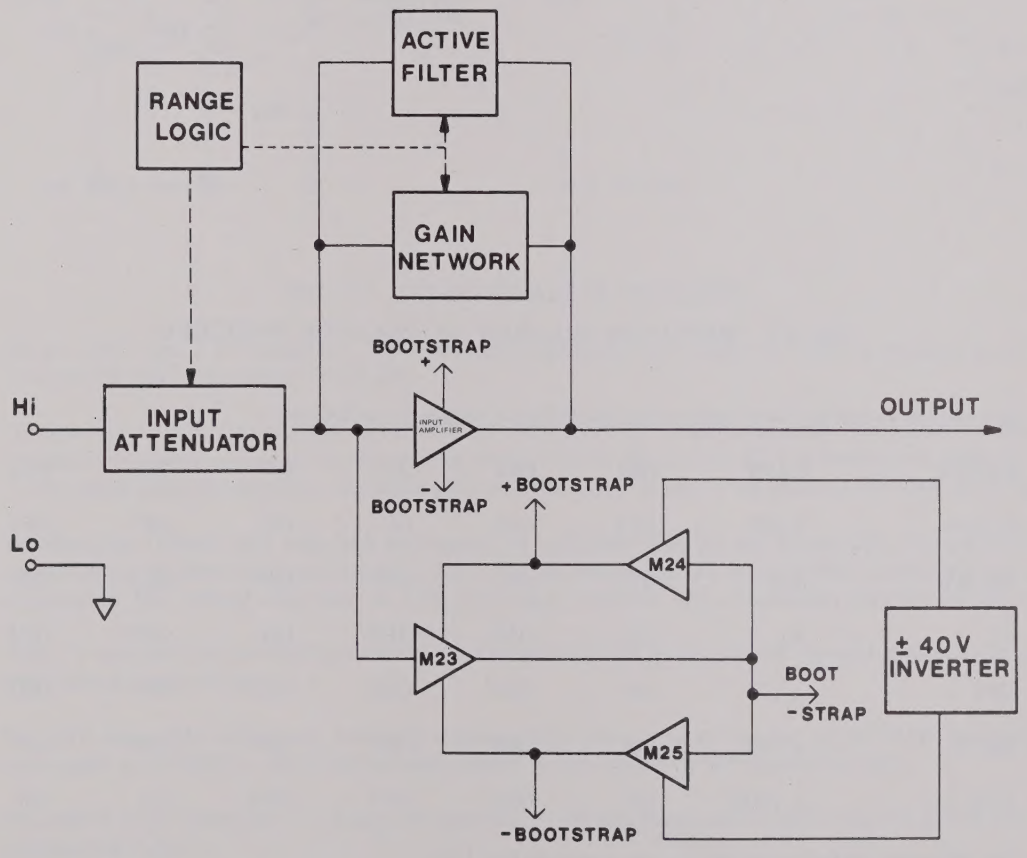


FIG. 1.1 SIMPLIFIED DIAGRAM OF DC ISOLATOR

1.2.1 Preamplifier Scaling

The simplified diagram, Fig. 1:2 shows the essential features of the isolator scaling circuit. For the purpose of explanation the same symbols are used (Black triangular contact normally 'made', white triangular contact normally 'open') regardless of whether the switching is accomplished electronically (F.E.T.) or by means of relay contacts. In Fig. 1:2 all switching is shown in the 1V RANGE position.

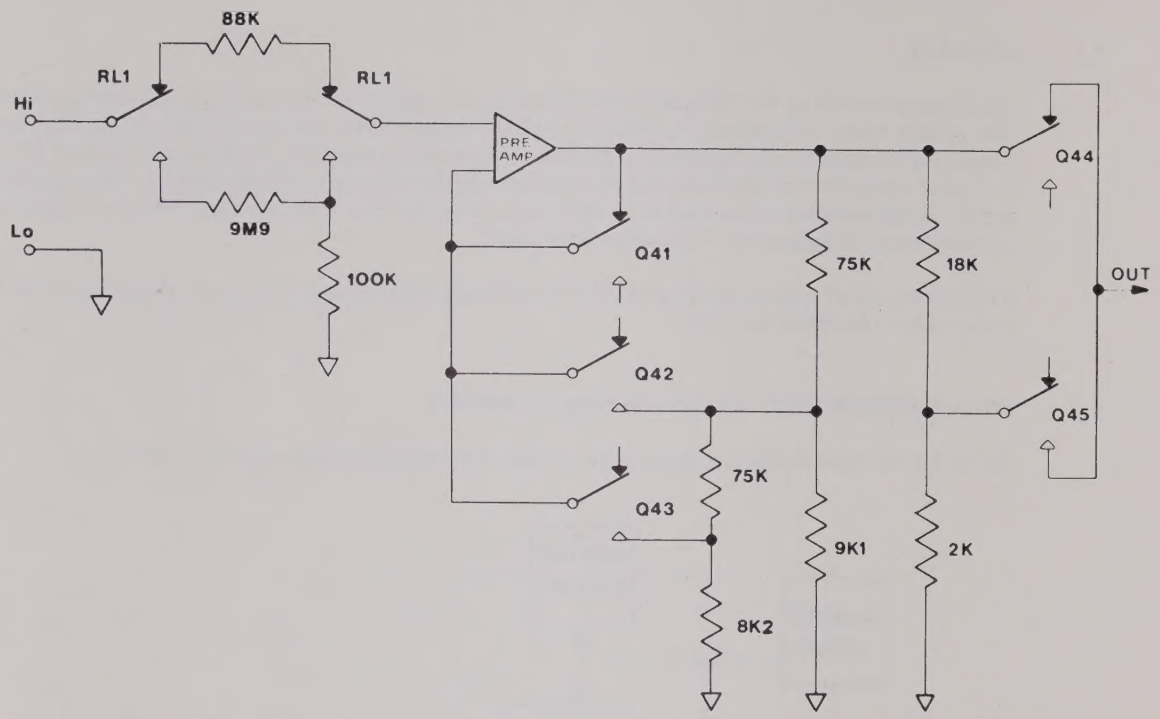


FIG. 1:2 SIMPLIFIED DIAGRAM OF ISOLATOR SWITCHING

The various switching combinations for the different ranges are as follows:–

RANGE	GAIN	Q41	Q42	Q43	Q44	Q45	RL1
10 mV	X100	OFF	OFF	ON	ON	OFF	OFF
100 mV	X10	OFF	ON	OFF	ON	OFF	OFF
1 V	X1	ON	OFF	OFF	ON	OFF	OFF
10 V	÷ 10	ON	OFF	OFF	OFF	ON	OFF
100 V	÷ 100	ON	OFF	OFF	ON	OFF	ON
1000 V	÷ 1000	ON	OFF	OFF	OFF	ON	ON

The different configuration circuits are shown in Fig. 1:3.

Having grasped the basic essentials, reference should be made to circuit diagram No. 430019, Sheet 2 for a more detailed explanation.

Resistor chain R1 – R4, 100 kΩ total, is in series with the Hi input on all ranges from 10 mV – 10 V. The amplifier end of R4 is clamped by zener diodes ZD5, ZD6 and Q49, Q50 to the bootstrap rail which is in turn clamped to Lo (0) by zener diodes, ZD7, ZD8. This means that the amplifier input can never exceed approximately ± 35V: the sum of the zener diode voltage drops. The 100 kΩ chain limits the current in overload The power dissipation of the chain is such that 1000 V can be applied continuously.

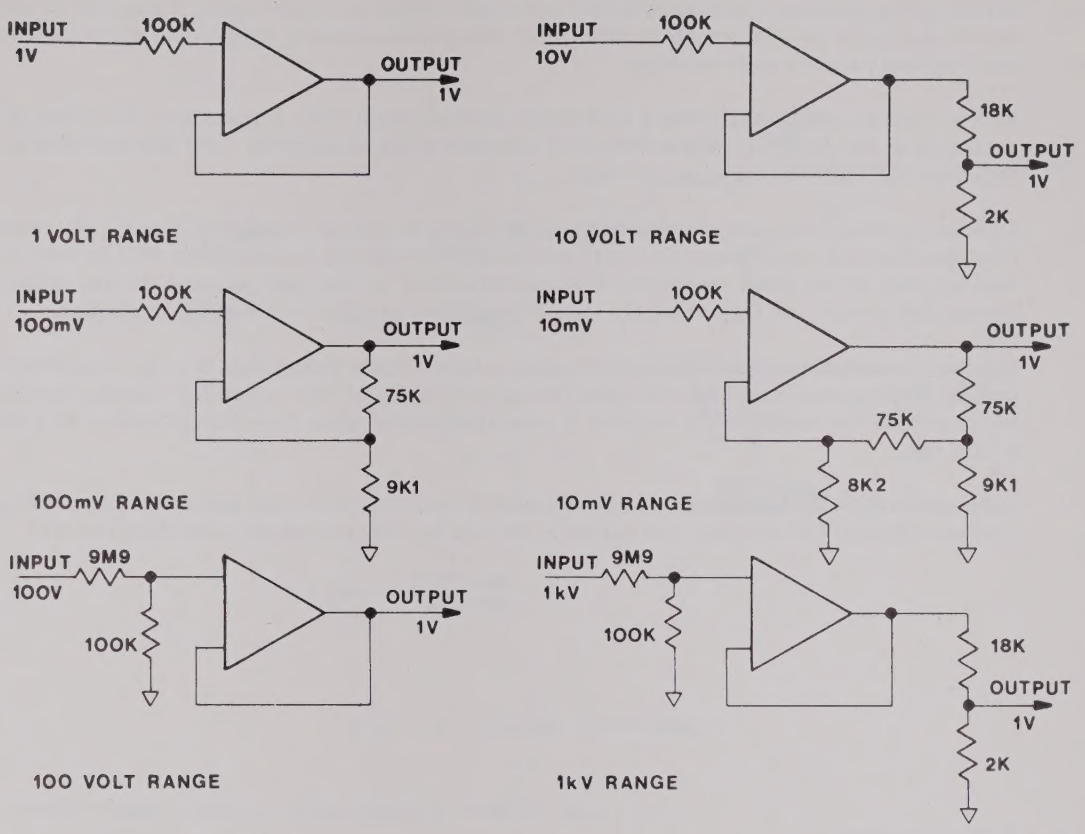


FIG. 1:3 SEPARATE RANGE SWITCHING

On the 100 V and 1 KV ranges a ÷ 100, 10M input attenuator is switched in. This is a matched set of resistors for low temperature coefficient.

On selecting 10 mV, Q43 and Q44 are turned on: all other F.E.T's are turned off. The output of the preamplifier is then connected to its inverting input via R 21, R22, R24, R25 an attenuator chain of ÷ 100 which gives the amplifier an overall gain of X100. Q44 connects the preamplifier directly to the output.

On selecting 100mV Q42 and Q44 are turned on: all other F.E.T's are turned off. The preamplifier is connected to its inverting input via R21, R22, but the output of the preamplifier is attenuated by a ÷ 10 attenuator. The overall amp gain is X10. Q44 again connects the preamplifier directly to the output.

With 1V selected Q41 and Q44 are turned on. The preamplifier output is now connected directly to its inverting input giving a gain of unity.

For 10V range Q41 is kept on, retaining a preamplifier gain of unity but the output of the preamplifier is attenuated by 10 (R33 – R34) before being passed to the output via Q45 instead of Q44.

The 100 V range selects the 1 V range and inserts a ÷ 100 attenuator (R57, R60) between the Hi and the preamplifier input.

The 1 KV range selects the 10 V range and also inserts the same ÷ 100 attenuator at the front end.

1.2.2 Preamplifier

The preamplifier is designed to present an input impedance of greater than 10000 MΩ for signals up to ± 20 V.

Bootstrapping (tracking of both ground lines and supply voltage with input signal) is essential for correct operation of input bias compensation, input offset voltage compensation, temperature compensation, F.E.T. switching and common mode rejection.

M23 is a high impedance buffer which looks at the inverting input of the preamplifier. The offset of M23 is adjusted so that its input is within 100 μV of the input of the preamplifier. M23 thus functions as a low impedance rail following the signal precisely.

By means of zener diode level shifting M24 and M25 produce outputs tracking +10V and −10V respectively from the bootstrap rail. These rails power the preamplifier and the bootstrap-amp M23 as well as driving the switching to the F.E.T. gates. For example with +15V on the high terminal the +ve supply of the preamplifier is +25V and the −ve supply +5V. This produces excellent common mode rejection.

It should be obvious that this immediately requires a higher supply voltage than the ± 15 V stabilized rails provide. With the maximum +20 V of signal this means a supply of +30 V stabilized is needed for the +BS rail and to provide this nearly 40 V is required. A capacitive inverter driven from M26 provides ± 38 V from the ± 15 V rails.

Zener diodes ZD3, ZD4 provide levels approximately fifteen volts above and below bootstrap. Emitter followers Q52 and Q53 provide a low output impedance for these rails which power M24 and M25.

1.2.3 Drift compensation

Q59 of the preamplifier is a well matched monolithic NPN transistor pair exhibiting minimal voltage drift and low noise characteristics.

To compensate for the current gain match of Q59 at different temperatures (approx 1%/^{o}C), the base emitter voltage is sensed by M28. Its output is linearised by Q60 which has a temperature coefficient similar to that of Q59. Hence the input bias current is kept constant.

M27 is the output buffer of the preamplifier.

1.2.4 Filtering

In the FILTER mode, a 2 pole active filter is switched in by Q46 and Q47. This provides 36 dB attenuation at 50 Hz increasing at 40 dB per decade, and settles to 0.001% in 350 mS. To allow for fast read rates, negligible filtering takes place in the DC Isolation circuitry in the FILTER mode, although an effective 70 dB attenuation at line frequency is still present in the A–D circuitry due to the line locking feature (see section 1.3.2.8).

On the 10 mV range only, a long time constant single pole filter is always switched in by Q40 providing 36 dB attenuation at 50 Hz and settling to .001% in approximately 10 secs.

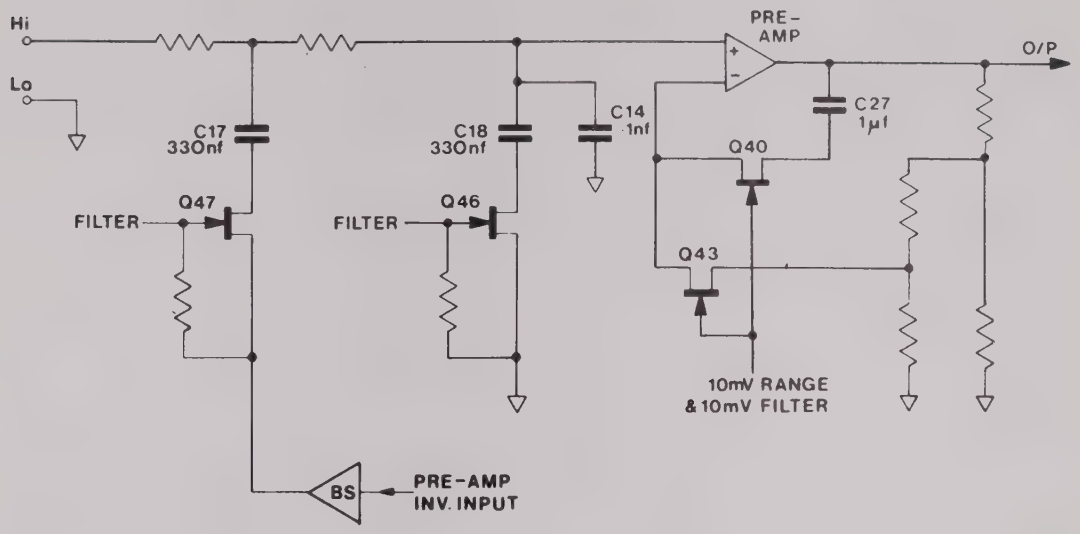


FIG. 1:4 FILTER NETWORK

1.2.5 Isolator range coding/decoding (Drawing 430019, sheet 1).

M9 – M14 are optical isolators separating the auto range digital circuits from the isolator circuit. The outputs of M9, M10, M11 form a range code in BCD format. M12 calls up the resistance converter card, M13 the AC card and M14 filter.

Q18 – Q23, Q27 and the resistor diode matrix R182, R189, D101 – D140 decode the BCD from M9 – M11 and recode it for the AC card and the resistance card. Q28 – Q30, Q33 – Q37 code the drive to the F.E.T's on the DC isolator.

Examining the BCD code more closely:

Range	M9	M10	M11	Q18	Q19	Q20	Q21	Q22	Q23
10 mV	0	0	1	1	1	0	0	0	1
100 mV	0	1	0	1	0	1	0	1	0
1 V	0	1	0	1	0	0	0	1	1
10 V	1	0	0	0	1	1	1	0	0
100 V	1	0	1	0	1	0	1	0	1
1 kV	1	1	0	0	0	1	1	1	0

In the case of Q18 – Q23 a '1' represents $\approx$+15 V and a '0' $\approx$ –15 V.

These codes remain the same whether DC, AC or Ω is selected. The outputs of the diode matrix following Q18, Q23 are modified by the selections of DC, AC or Ω.

1.2.5.1 DC coding

When 10 mV is selected the collectors of Q18, Q19, Q23 are at +15 V. Consequently the junction of D127 – D131/R188 is +ve and this turns F.E.T. Q43 on, which gives a preamp gain of X100.

Q21 is –ve, which turns Q28 on and in turn Q35. This turns Q37 off. The collector of Q37 is now +ve, turning F.E.T. Q44 on, connecting the preamp directly to the output.

When 100 mV is selected, the collectors of Q18, Q20, Q22 are at +15 V consequently the junction of D117 – D121/R186 is +ve. This turns Q29 off and in turn Q33 off. The collector of Q33 goes +ve and this turns F.E.T. Q42 on giving a preamp gain of X10. Q21 is still –ve, thus Q28 is on, Q35 off, Q37 off, and F.E.T. Q44 on, again connecting the preamp directly to the output.

When 1 V is selected neither of the two previous codes are present. Q33 and Q34 are both on; this turns Q36 off and F.E.T. Q41 on, giving a preamp gain of X1. Q21 is still –ve, so Q44 is still on.

When 10 V is selected Q20 and Q21 are high. The junction of D132 – D134, D140, R189 is +ve, turning Q28 off, turning F.E.T. Q45 on. Q36 is still off. This calls up a preamp of unity again but divides the output by ten before passing it to the output.

On both 100 V and 1 KV, RL1 is pulled in, connecting the 100:1 input attenuator in circuit. Q27 is at +15 when ***either*** Q19 is low and Q23 low ***or*** Q22 low and Q20 low. Thus on 100 V and 1 KV the junction of D114 – D116, D147, R197 is high, turning Q26 on, pulling in RL1.

If 10 MΩ is incorrectly selected in DC the 1 KV range will be called up by the range logic on the analogue side of the opto-isolators.

1.2.5.2 AC coding

When AC is selected M13 turns Q31/Q32 on. These pull RL1 in, turn Q35, Q37 on and F.E.T's Q44/Q45 off. The preamp on the DC isolator is thus totally disconnected from the output. This now receives its input via R38 from the AC converter. Note that these actions are effective on AC regardless of the range selected.

The AC converter receives 4 lines of coded range information via pins 1,3,5,7.

Range	Pin 1	Pin 3	Pin 5	Pin 7
10 mV	0	1	1	1
100 mV	0	1	0	1
1 V	0	0	0	1
10 V	1	0	0	1
100 V	0	0	0	0
1 KV	1	0	0	0

If 10 MΩ is incorrectly selected in AC the 1 KV range will be called up, by the range logic on the analogue side of the opto-isolators.

1.2.5.3 Resistance Converter Coding

The collectors of Q18 – Q23 are fed directly to the resistance converter without being modified in the diode matrix. However, before the opto-isolators in the range logic an extra range, 10 MΩ, is added. The BCD code for this is:–

M9	M10	M11	Q18	Q19	Q20	Q21	Q22	Q23	
1	1	1	0	0	0	1	1	1	10 MΩ

The DC isolator is used on the ohms ranges, with a gain of X1 on all except the 10Ω range, when it is X10. On selecting ohms, M12 turns Q24 on and Q25 off. This modifies the diode matrix outputs to the DC isolator, holding Q26 and RL1 off on the '100 V' (100 K) and 1 KV (1 MΩ) positions. Q28, Q35 and therefore F.E.T. Q44 are also turned on.

1.2.5.4 Filter

M14 passes the filter command to Q38, turning it on. F.E.T's Q46 and Q47 are both turned on via D1 and D2, switching in the 2 pole active filter of the DC isolator. A line is also taken from Q38 to the AC converter.

On the 10 mV range only, F.E.T. Q40 is switched on irrespective of the FILTER or $\overline{\text{FILTER}}$ mode being selected to switch in a single pole long time constant filter.

FILTER can be called up, and is effective on DC, AC and OHMS (where it is useful for resistances in the 10 MΩ region or where long unscreened leads are used).

1.2.6 Auto Range and Range Selection (Drawing No. 430019, Sheet 3).

Range selection can be made by front panel push button, by remote programming via the rear panel, or automatically by auto range. Function selection can be by either front panel or remote programming.

The basis of range selection is M2, a presettable up – down counter. If AUTO is not selected, the counter is prohibited from clocking up or down and the 3 output lines are similar to the three presettable input lines. These input lines come from M1 a 4 input – 2 way multiplexer. Selections of which 3 inputs are connected to the outputs is controlled by front panel or programme REMOTE function selection. The three outputs of the up – down counter drive opto-isolators M9 – M11 feeding a BCD range code to the DC isolator. (See 1.2.5). M6, a BCD – decimal decoder, together with M5 and Q8 – Q12 provide remote range indication for the BCD output option and range decimal point drives for the analogue to digital converter display.

When autorange is selected (AUTO) two modes are possible. If there is an overload on the range in use (i.e.$>$ 200,000 digits) an UP command will come from the digital board via J3 – 13 ***and*** the counter will clock up one range. After a fixed period ($\approx$10 mS in FILTER and $\approx$500 mS in FILTER) the counter will either remain in a fixed state if the reading is on scale or if still overloaded will clock UP again. This will continue until an on scale reading is achieved, or the highest range reached. Gating on M7 prevents clocking beyond the top range. Alternatively, if the reading is too small for reasonable accuracy on the range in use (i.e.$<$ 10,000 digits) a DOWN command will come from the digital board via J3 – 14 and the counter will clock down one range. Again, after a fixed period, the counter will either remain in a fixed state if the reading is between 10,000 and 200,000 digits or if still underscale, will clock DOWN again. This will continue until a reading of $>$10,000 digits is achieved or the bottom range reached. Gating on M4 prevents clocking beyond the bottom range.

The 10 mV DC range can only be selected by the front panel switch or remote programming and the bottom range in the AUTO mode is 100 mV or 100Ω.

An identical quad 2 way multiplexer M8 is used for function selections. Front panel or remote programming again selects which information to transfer.

M3, Q7, Q13, Q14, Q17 decode the multiplexer (M8) outputs into AC, DC, OHMS and FILTER which connect to the analogue-to-digital converter via J3 and to the DC isolator via opto-isolators M12 – M14 (only $\overline{\Omega}$ and $\overline{AC}$ are transmitted, DC is $\overline{\Omega}$ and $\overline{AC}$).

There are two methods of remote selection. A remote programme link is fitted at the factory and EITHER front panel OR programming can call up REMOTE. If this link is removed, then only the front panel button can call up REMOTE and the programme line pin 12 becomes an output flag indicating $\overline{\text{REMOTE}}$.

1.2.7 Models 01 and 11 AC Converter

The Model 01 AC Converter is an electronic True RMS AC to DC converter operating over a bandwidth of 30 Hz to 1 MHz and incorporating 5 ranges from 100 mV full range to 1000 volts.

The Model 11 AC Converter covers 4 ranges from 1 V to 1000 V and operates up to 100 kHz.

The circuitry is on one printed circuit assembly which plugs into the underside of the DC isolator board assembly. There are two main circuit sections, the preamplifier (Drawing No. 430016, sheet 1) which buffers and ranges the signal in order to present .9 volts full range to the AC to DC converter section (Drawing No. 430016, sheet 2).

1.2.7.1 Preamplifier

The simplified diagram, Fig. 1:5 shows the essential features of the preamplifier and scaling circuit. For the purposes of explanation the same symbols are used (black triangular contact normally "made", white contact normally "open") regardless of whether the switching is accomplished electronically (F.E.T.) or by means of relay contacts. In Fig. 1:5 all switching is shown in the 1 V range position.

The various switching combinations for the different ranges are as follows:–

VOLTS RANGE	OVERALL VOLTS GAIN	RELAY K2	F.E.T. Q2	F.E.T. Q4	F.E.T. Q3	F.E.T. Q5
10 mV	90	6 – 5	OFF	OFF	ON	OFF
100 mV	9	6 – 5	OFF	OFF	ON	ON
1 V	.9	6 – 5	OFF	ON	OFF	ON
10 V	.09	6 – 5	ON	ON	OFF	ON
100 V	.009	6 – 7	OFF	ON	OFF	ON
1000 V	.0009	6 – 7	ON	ON	OFF	ON

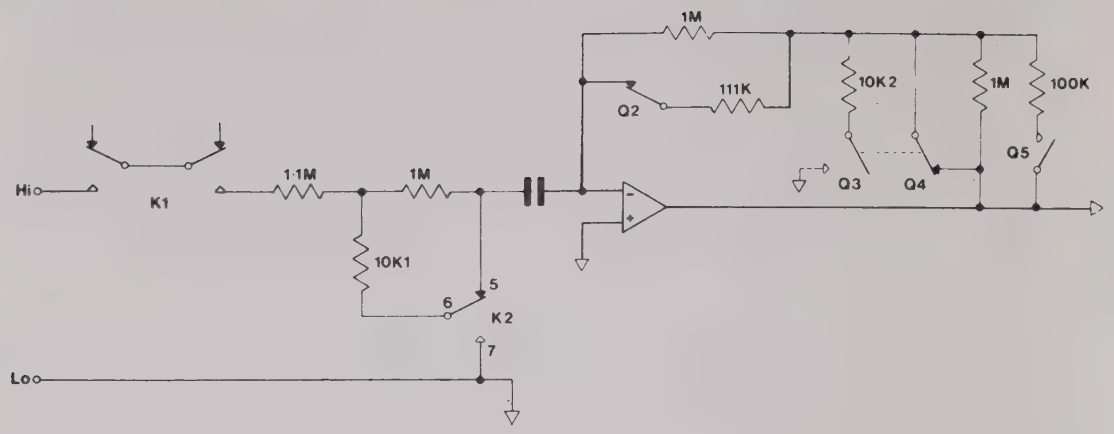


FIG. 1:5

Although the reader could, no doubt, puzzle out the different circuit configuration on each range, it will be quicker to simplify the circuit still further and to show separate drawings for each RANGE setting as shown in Fig. 1:6.

Note that in the model 11 AC converter the 100 mV range is omitted, but all other circuit descriptions are similar to the model 01.

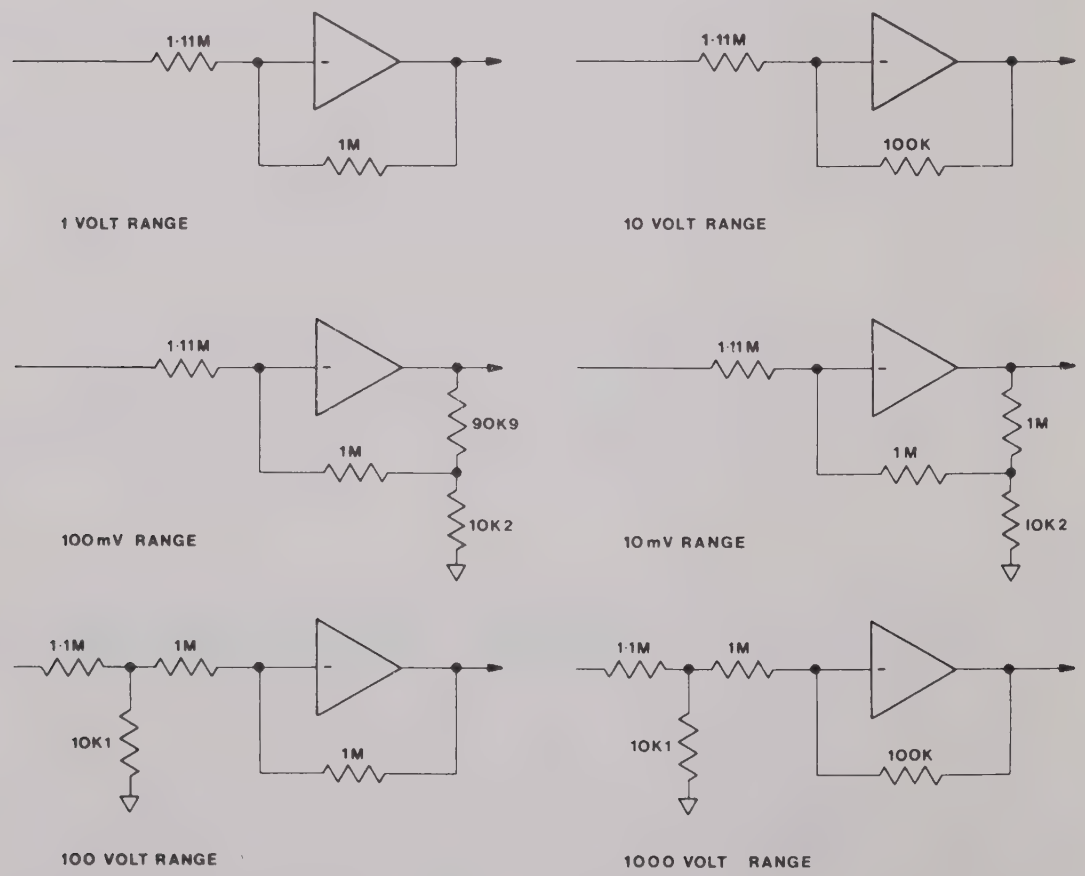


FIG. 1:6 AC PREAMPLIFIER GAIN CONFIGURATIONS

Having grasped the basic essentials, reference should be made to Circuit Diagram No. 430016, Sheet 1.

Relay K1 is energized when AC is selected and directly connects resistor chain R3 – R6 to the Hi input terminal. The four resistors total 1.11 MΩ and are capable of dissipating 2 Watts. Capacitors C2, C3, C4 and R7 provide frequency compensation to increase the accuracy at high frequencies. For the purposes of this description no further reference to frequency compensation will be made although, of course, every gain defining resistor is frequency compensated.

The signal current passing through R3 – R6 either flows into the virtual earth (TP1) of the preamplifier via R10 and C8 or, if K2 is energized 99% of the current is shunted to common providing the ÷ 100 condition required on the 100 and 1000 volt ranges.

The preamplifier itself is of the inverting type, is of high bandwidth and has remarkably low offset drift characteristics. Q6, Q7 and Q10 form a very high bandwidth unity gain buffer. Q6 is a dual F.E.T. operating in a unique differential mode such that each half tracks thermally. M1 is a fast operational amplifier. F.S.V. resistors R51 and R52 are selected to offset M1 such that its offset drift is very low, R41 and R42 such that the offset drift of Q6 is very low and R34 and R35 to provide zero output offset of the whole preamplifier. This is finely adjusted by R36.

The feedback network has been described previously (see Fig. 1:5 and 1:6). Note that the gain defining resistors are associated with trim adjust potentiometers and that where this is the case the compensating capacitor network is also adjustable. Two "twisted-wire" capacitors are also incorporated for very fine frequency flatness adjustments.

The preamplifier is AC coupled at its input with a 1000 volt capacitor allowing AC measurements in the presence of very high DC bias potentials. Although the AC gain is high on the millivolt ranges C22 and C23 limit the DC gain to unity.

1.2.7.2 RMS Converter (Circuit Diagram No. 430016, Sheet 2).

The RMS Converter takes the scaled AC signal from the preamplifier and converts it to an equivalent DC signal suitable for Analogue-to-Digital conversion. The conversion technique is electronic true RMS sensing as shown in the simplified block diagram Fig. 1:7.

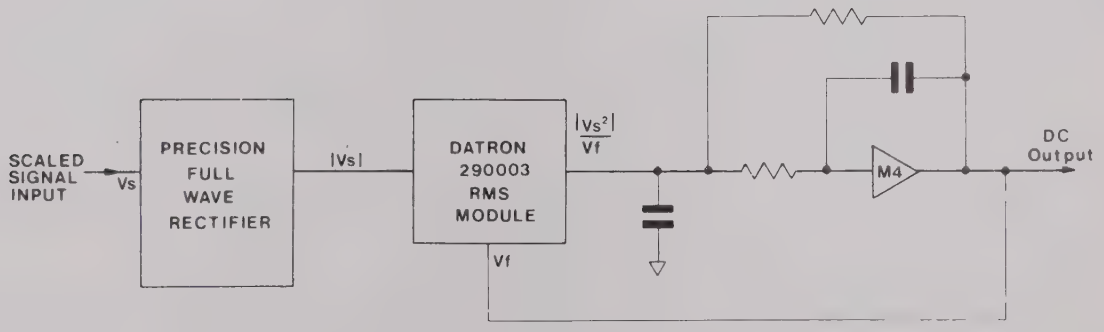


FIG. 1:7 TRUE RMS CONVERTER

With reference to Fig. 1:7 the sections are explained except for the circuitry around M4 which forms a 2-pole active filter with approximately 60 dB rejection at 40 Hz (referred to input).

Mathematically the description is as follows:–

$$\text{Output voltage, Vo} = \frac{\overline{|Vs|^2}}{Vf}$$

where bar notation indicates overrange.

$|Vs|$ is the rectified form of the input signal Vs.

Since the loop is closed:

$$Vo = Vf$$

$$\text{therefore} \quad Vo^2 = \overline{Vs^2} \quad (Vs^2 = |Vs|^2)$$

$$Vo = \sqrt{\overline{Vs^2}}$$

Thus Vo is the true RMS value of Vs.

With reference to drawing No. 430016, sheet 2, M2 and M3 form the full-wave rectifier which is of the summing type, that is, M2 is a precision half-wave rectifier inverter, the output of which is summed with the non-inverted signal, with a weighting of 2:1, at the input of M3. This forces a full-wave rectified current to flow in RMS module M6. Although the simplified block diagram of Fig. 1:7 implied that the RMS module operated with voltages, it in fact operates on currents both in and out. Trim resistor R61 balances the rectifier such that a non-symmetrical waveform provides the same output whether inverted or not.

The output current from the RMS module passes into filter-buffer M4 and is converted to the output voltage. Q15 and Q16 switch in additional capacitors for operating in the FILTER mode down to 40 Hz or lower. M5 is a voltage to current converter which provides a feedback current to the RMS module which is proportional to the output voltage. R98, R109, R115 are zero adjusts for M3, M4, M5 respectively, R67 is an overall gain adjust and R70 is a high crest factor gain adjust. All these components are coarsely adjusted with FSV resistors. Q23 is turned on in AC and off in the other functions and it switches the output of the AC converter into the output buffer M22 of the DC isolator.

1.2.8 Resistance Converter – OPTION 03 (Drawing No. 430027, Sheet 1).

This is a true 4-wire measurement and incorporates an active guard for in-circuit measurement. In many cases, 2-wire measurement is adequate and more convenient: a front panel switch is incorporated to provide for this.

The instrument functions by measuring the voltage across an unknown resistance with a known, constant, current flowing in it.

As can be seen in Section 5.4 of the Operating Manual, 4-wire measurement can eliminate the effects of lead resistance. However, for short leads of 24/0.2mm wire, the few tens of milliohms error when measuring greater than 100 ohms soon become negligible; from this point on, 2-wire measurement becomes more attractive. Referring to drawing No. 430027, the converter is in two parts: a constant current source covering 6 decades from 10 mA – 100 nA and a low drift voltage follower. It should be noted that when the resistance converter is fitted the DC isolator Lo is no longer directly connected to front panel Lo, but goes via RL1 on the resistance converter. On DC, isolator Lo connects to front panel Lo. On Ohms, the front panel Lo is connected to the –ve input of M3, the +ve input of which is referred to DC isolator Lo. (This remains reference common). M3 together with output follower Q9, will thus apply a voltage at I+ such that the voltage at front panel Lo is reference 0 + offset M3 (which is zeroed to $< 10\ \mu V$).

Consider 2-wire measurement for ease of explanation: I+ linked to Hi, I– linked to Lo, the unknown resistance between Hi and Lo. A constant current flows from Hi to Lo through the unknown resistance. The Lo terminal is maintained at $0 \pm < 10\ \mu V$. The Hi terminal (DVM isolator input) is, I constant x R unknown, above Lo. As long as the error on Lo is small referred to reference 0, the DVM will read the correct resistance. The voltage offset error is kept small (<1 digit) by compensating M3 in the same manner used for M21 on the isolator. (See Section 2, Maintenance).

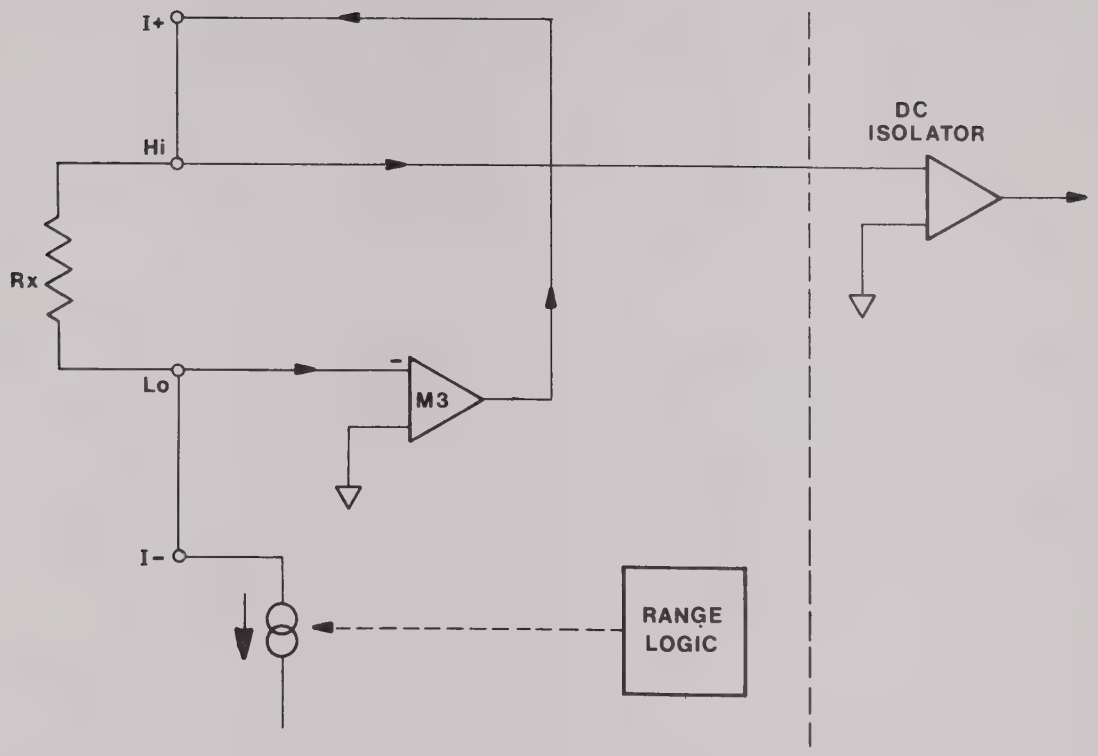


FIG. 1:8 SIMPLIFIED Ω SCHEMATIC

Seven decades of ohms ranges are provided by 6 ranges of current and 2 ranges of isolator voltage gain. The diode switch matrix on the isolator board provides 7 lines of information in BCD code. A small matrix on the Ω card provides gate drive for 6 current selector F.E.T's (Q2 – Q5, Q7, Q8) and for F.E.T. Q6, used for leakage reduction. M1 converts the –5 V reference voltage from the digital assembly into a current of 500 μA flowing in R5. R5, M2 and the switched resistor chain R6 – R54 form a current mirror: the current flowing in the chain on the right of M3 is equal to the current flowing in R5 on the left of M3 multiplied by the ratio of the right hand resistor to R5. Put even more simply, the voltage across R5 must equal the voltage across the right hand chain + offset voltage of M2. Thus a fixed voltage difference appears across the resistance chain; by varying the value of resistor, the current is varied selecting tappings on the chain.

The various currents produced are:–

		F.E.T's ON
100 Ω	10 mA	Q2
1 kΩ	1 mA	Q3
10 kΩ	100 μA	Q4
100 kΩ	10 μA	Q5
1 MΩ	1 μA	Q6 Q7
10 MΩ	100 nA	Q6 Q8

4 basic currents are provided and a 1000:1 attenuator used with two of these currents provides two more ranges.

If difficulty is experienced in understanding how the 2M/2K functions as a current divider, remember that the point the 2M is connected to is I– and this will be at most only a hundred ohms from Lo. Lo is maintained within a few μV of ref. 0 and the 2K is taken to the ref. 0. Thus the 2M is in effect shunting the 2K and the same voltage therefore exists across the 2M as across the 2K. Q6 is switched in when Q7 and Q8 are on, to sink gate leakage currents from Q2, Q5 to ground.

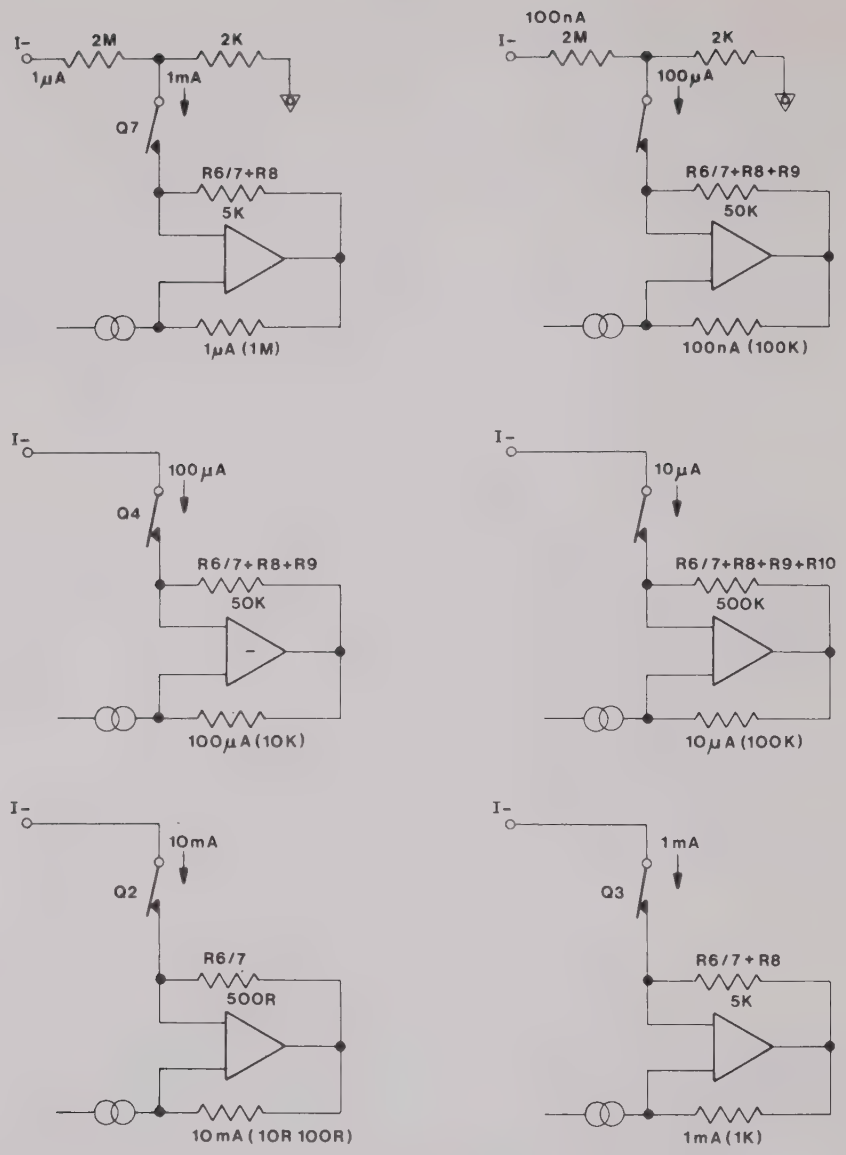


FIG. 1:9 SIMPLIFIED Ω CURRENT SWITCHING

Protection from overload in the current leads is achieved by positive temperature coefficient thermistors R47 (in the I+ lead) and R48 (in the I– lead). Diodes D31 – D34 and zeners D36, D37 prevent excessive voltages from reaching the current generator or the voltage follower output. Protection is such that 240 V r.m.s. may be applied between I+ and I– or I+, I– to ohms guard or Lo to ohms guard. Following the application of such an accidental overload the PTC resistors R47, R48 have to cool down and this may take several minutes.

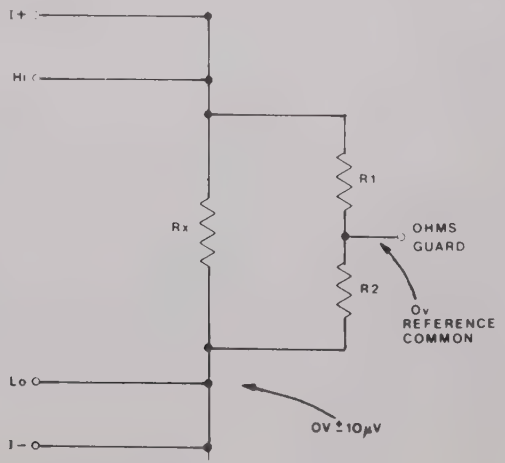


FIG. 1:10 Ω GUARD

The use of ohms guard permits in circuit measurement of resistors, provided shunt paths are greater than 250Ω and a suitable tapping point is available. Consider Fig. 1:10. Ω Guard is reference 0, Lo is, as previously explained, actively maintained within a few μV of ref. 0. Thus there is no voltage across R2 and consequently no current in it. R2 can cause no measurement error. Thus all the constant current because it cannot flow in R2, must flow in the unknown resistance. Voltage follower M3 will simply pass more current into R1 from the I+ terminal until the selected current for the particular range flows through Rx.

1.3 ANALOGUE TO DIGITAL CONVERTER

1.3.1 Analogue Section

1.3.1.1 General Principles

Section 1.3 and Fig. 1:3 of the Operating Manual gives a very basic description of the principles of integration involved. This paragraph covers in more detail those general principles. Fig. 1:11 is a block diagram showing the essentials of the analogue section of the analogue to digital converter. Fig. 1:12 is a timing diagram which should be referred to in conjunction with Fig. 1:11 for a full appreciation of the circuit operation.

As explained in Section 1.3 of the Operating Manual the analogue section is controlled by timing pulses generated in the digital section and transferred via pulse transformers T2 and T3 to the analogue side. These timing pulses control the sequence from RESET to SIG to REF and back to RESET. The sequence is effected by using the timing pulses to set and then clock a 2 bit binary counter M44. The 2 bit output $\overline{AB}$ and its complement, AB drive logic gates which in turn operate F.E.T. switches Q1 – Q4, Q6 – Q9.

1.3.1.2 RESET Period and Auto Zero

During this period any residual charge from the previous reading cycle is removed from the integrator capacitor C30, and the AUTO ZERO circuitry stores the cumulative zero errors of M35, M36 and M37.

The RESET state is dictated by LOW (–15 V) states at both A and B from M44, when this occurs a HIGH (–10 V) state appears at the input pins 5 and 6 of the M46 NAND gate producing a LOW (–15 V) at pin 4. This turns off Q18, which switches Q4 (FAST RESET) on momentarily (approx 1 mS) via C17 and R26, and after a short delay (approx. 1 mS) set by C38 and R22 allows Q3 (RESET and Auto Zero) to switch ON. When B went to a logic '1' at the end of the previous SIG period, it reset M45 F/F to give a LOW state at the Q output (pin 13) which turned off Q14 allowing Q2 to turn on and turning off Q1. These states of Q1 and Q2 are maintained from the end of SIG through to REF and RESET.

Also, at the commencement of RESET $\overline{B}$ changes to a HIGH (–10 V) state. This appears at pin 12 & 13 of M46 NAND gate causing the output pin 11 to go LOW and turn OFF Q23 allowing F.E.T. switch Q8 to turn ON.

Now, during RESET the F.E.T. switches are in the states shown in Fig. 1:11. Q8 connects the output of M35 to the input of the integrator. Q3 and Q4 close the feedback loop and C30 assumed a charge such that when C32 samples the cumulative errors of M35, M36 and M37, the stored error is transferred via M49 to the non-inverting input of M38, to produce zero volts at TP9. This auto zero output from M49 is maintained during the following SIG and REF periods until being adjusted again, if necessary, during the next RESET period.

1.3.1.3 SIGNAL INTEGRATE Period

Following the RESET period, a timing pulse arrives at T3 the SIG pulse transformer. This sets the binary counter, forcing A to a HIGH state (–10 V) and ensuring that B is a Low state. The SIG pulse also appears at the clock input (pin 11) of 'D' type flip-flop M45, the Q output (pin 13) thus adopts the signal at the D input (pin 9) –10 V, a high state. This switches ON Q14 which switches on F.E.T. Q1 and switches OFF F.E.T. Q2. Q1 connects the unknown signal to the X5 amplifier input. Q8 is already ON following the RESET period and X5 the input signal appears at TP5 and is fed to the integrator.

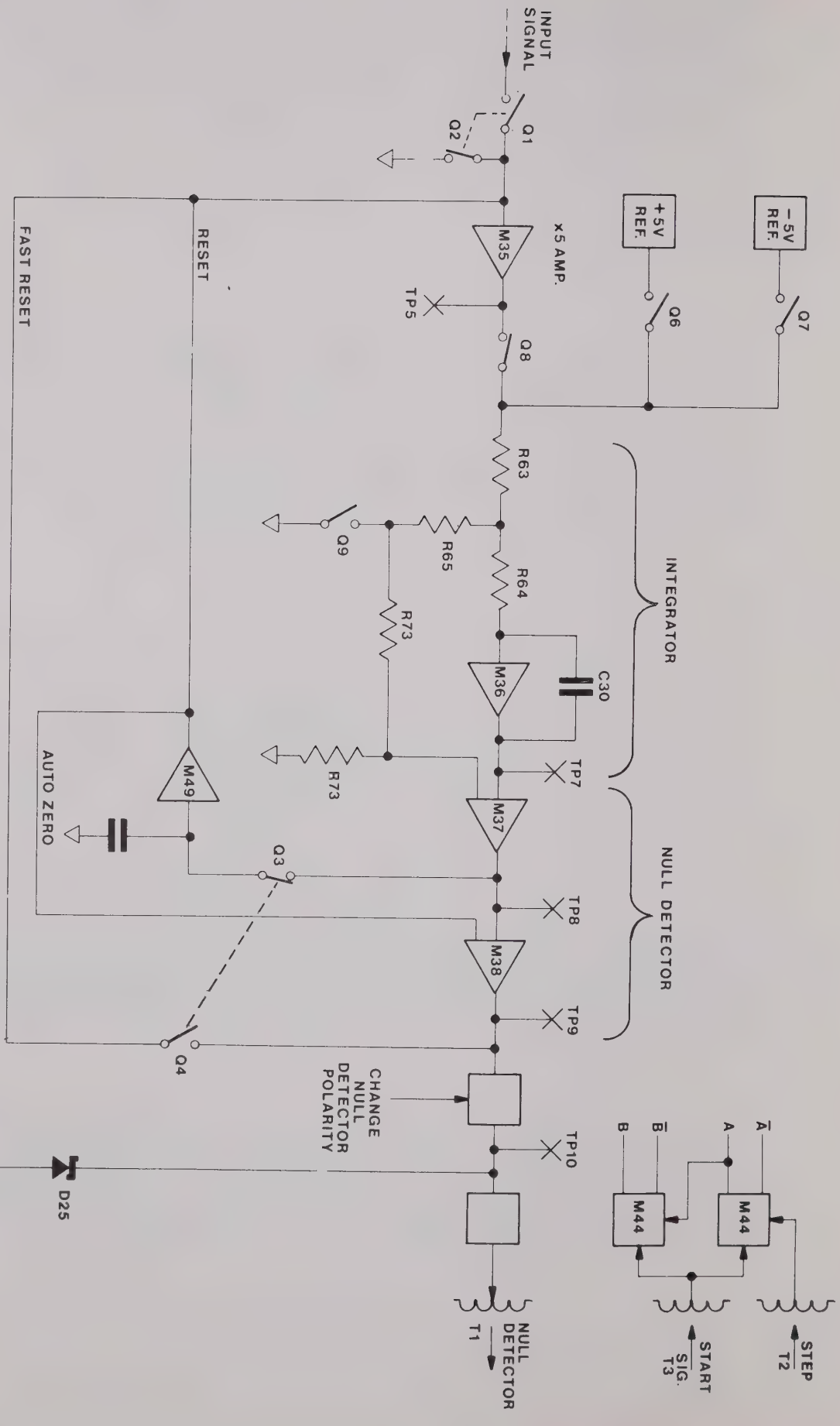


FIG. 1:11 SIMPLIFIED DIAGRAM OF ANALOGUE SECTION

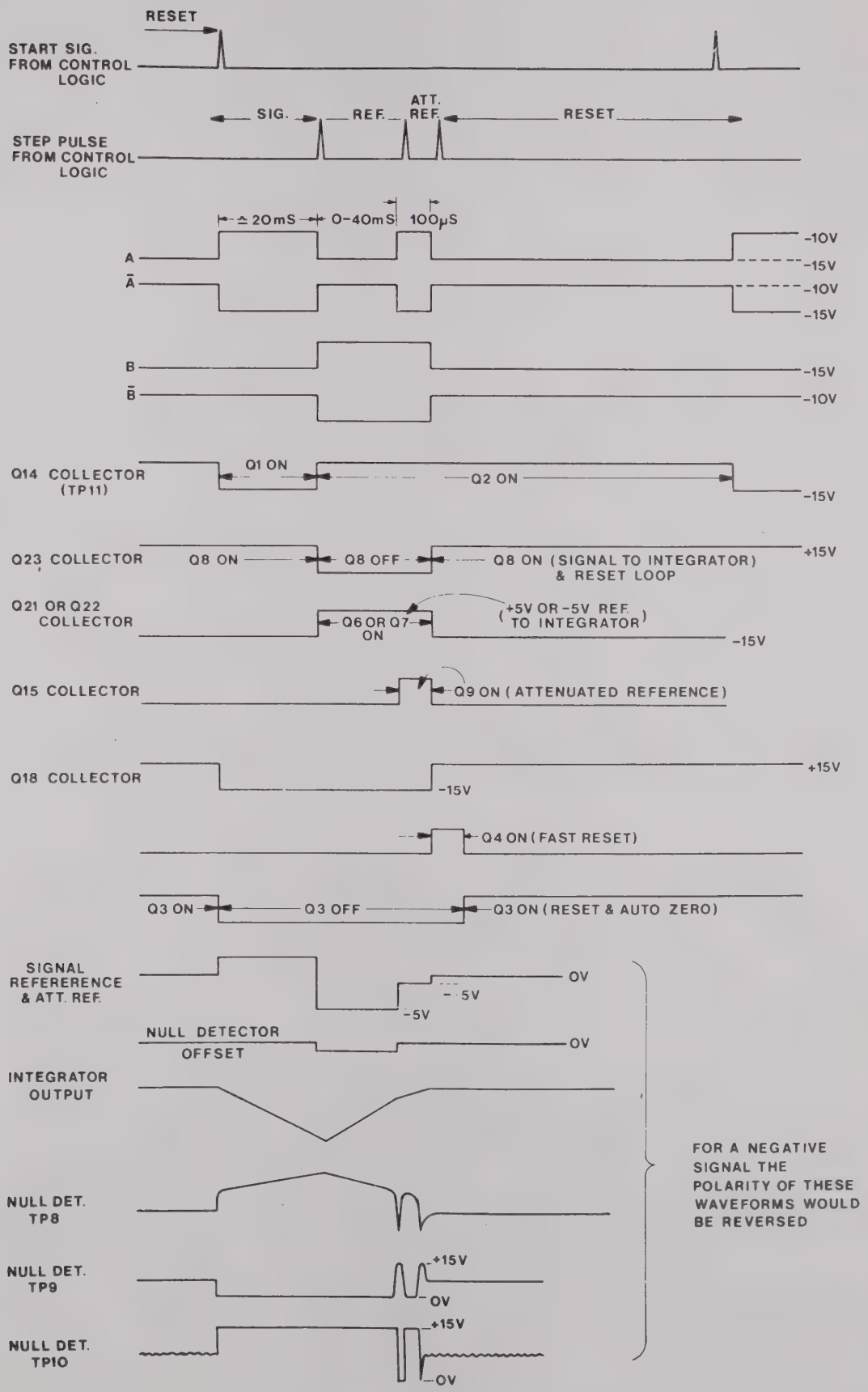


FIG. 1:12 A–D CONVERTER TIMING DIAGRAM

If the signal at TP5 is positive then the output of the integrator at TP7 will move off negatively as shown in Fig. 1:12. Meanwhile, the voltage at TP7 is much amplified by the first stage of the null detector M37. This stage incorporates clamping diodes D18 and D19 so that although a large output swing occurs when the voltage at TP7 departs from zero by only a small amount, the voltage at TP8 is clamped, again as shown in Fig. 1:12. Further null detector gain is introduced by M38 and through level shifting zener diode D23 to M42. At TP10, the null detector gain is such that the output is a logic level of either 0 V for a negative signal or +15 V for a positive signal as shown in Fig. 1:12. The logic voltage at TP10 is level shifted by zener diode D25 to provide either −9 V or −15 V via R29 at the D input (pin 5) of the 'D' type flip-flop M45. With a positive input signal the voltage at pin 5 is HIGH (−9 V).

1.3.1.4 REFERENCE INTEGRATE Period

After 20 mS of SIG a STEP pulse arrives at pin 3 of M44 to clock M44 and change A to a LOW (−15 V) and B to a HIGH (−10 V). $\overline{B}$ at NAND gate pin 13 changing to a LOW (−15 V) produces a HIGH (−14.3 V) at the output pin 11 and turns ON Q23 which switches OFF the signal path through Q8.

As explained in paragraph 1.3.1.3, with a positive input signal a HIGH state (−9 V) is present at 'D' input (pin 5) of 'D' type flip-flop M45 at the end of the SIG period.

Therefore, when $\overline{A}$ changes to a HIGH on the clock (pin 3) input of M45 at the end of SIG, the HIGH at the 'D' input (pin 5) is transferred to the Q output (pin 1). At the same time a LOW (−15 V) appears at the $\overline{Q}$ output (pin 2), which turns OFF Q22 allowing F.E.T. Q7 to switch ON, thus connecting the −5 V reference to the input of the integrator. Consequently, a reference signal of opposite polarity to the measured signal is applied to the integrator to discharge the capacitor. The reference integrator period required for discharging the capacitor C30 to zero volts will always be less than 40 mS (except with an overload signal). To overcome the problem of uncertainty near zero a small proportion of the reference voltage is fed forward to bias the null detector. This means that even with zero input signal there is a small reference ramp lasting for a period of time determined by the amount of feed forward (set by R80 for positive signals and R81 for negative signals). This ensures that a false null detector pulse is not produced as a result of spurious noise generated at the end of the SIG period. For a zero input the display would read several digits, and thus is compensated for in the main digital counter by ignoring the first few clock counts.

During the first part of the reference period, F.E.T. switch Q9 is turned OFF. This allows the reference voltage, attenuated by R73 and R72 to feed a small offset into the null detector. The polarity of the offset is such that the reference ramp from the integrator (TP7) reaches null detector threshold before the integrator voltage has reached 0 V. When this threshold is crossed, the logic level at the null detector output changes state, in this case from HIGH, (+15 V) to LOW (0 V), which transfers a first null detector pulse via T1 to the control logic. Following an appropriate synchonization delay in the control logic another STEP pulse arrives at T2 to clock M44, this changes A to a HIGH state (−10 V). This means that both inputs (pins 1 and 2) of NAND gate M46 are HIGH, producing a LOW state (−15 V) at pin 3, turning Q15 OFF which allows Q9 to turn ON. When Q9 switches ON, the reference voltage is attenuated by R63 and R65 and is effectively −0.5 V, also the small offset fed to the null detector via R73 and R72 is removed. The removal of this offset immediately resets the null detector to its previous state with a HIGH (+15 V) at TP10. The reference to the integrator having been attenuated to 1/10 of its previous value, means that the integrator capacitor C30 now discharges at 1/10 of the previous rate and continues until zero charge is reached. At this point the threshold of the null detector, now 0 V, is again crossed and the logic level at the null detector output again changes to LOW (0 V) transferring a second null detector pulse via T1 to the control logic. The attenuated reference period lasts for approx 100 μS, whereas the full reference period varies from almost zero to 40 mS for a zero to full scale input signal respectively. Following the second null detector pulse another STEP pulse arrives at T2 which clocks M44, changing both A and B to a LOW (−15 V) and thus switching the analogue circuitry back into the RESET mode as described in paragraph 1.3.1.2.

1.3.1.5 References

Fig 1.13 shows the essentials of the circuitry for producing the stable +5V and –5V reference voltages.

The stability of the reference is dependent upon the inherent stability of device M39. This device produces an output voltage of +7V with very low temperature coefficient and extremely good long-term stability.

To obtain the 5V reference required, inverting amplifier M40 is used with the scaling resistors R66 and R67 being trimmed by R37, R38 and R70, R71 respectively. R76 is used as a fine adjustment to calibrate the output of M40 to –5V exactly. Similarly to produce the +5V reference, another inverting amplifier M41 is used, having unity gain and being finely trimmed by R78.

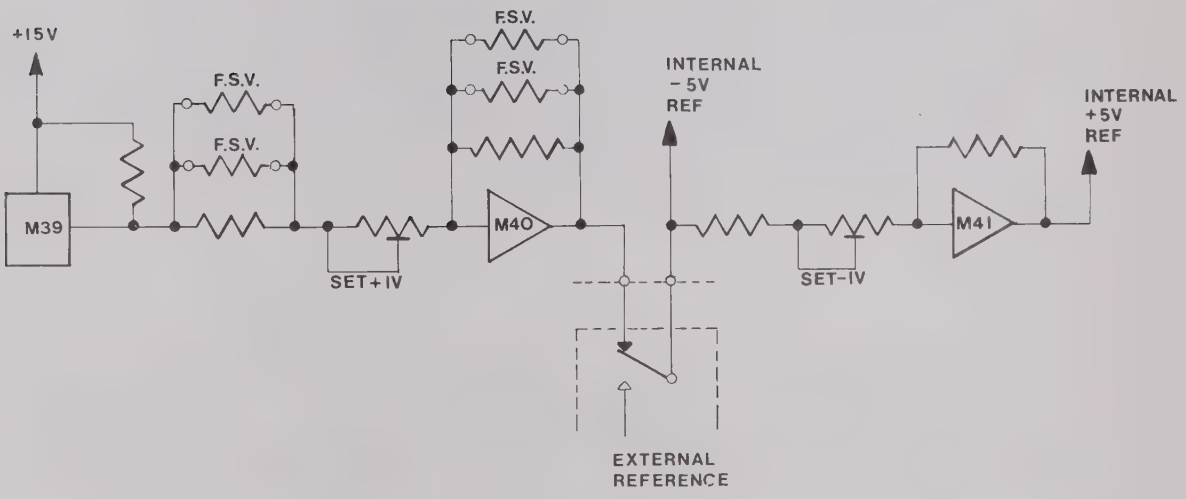


FIG. 1:13 REFERENCES

1.3.1.6 Using an External Reference

As explained in paragraph 1.3.5, provision is made for replacing the internal reference voltage by an externally generated voltage reference source. When using an internal reference, the polarity of that reference is selected opposite to that of the input signal to effect the charging and discharging action of the integrator as described in paragraph 1.3 of the Operating Manual.

Now, with an external reference, this polarity selection must still operate even though that external reference may be either polarity at the rear connector.

Block diagram 1:14 outlines the essentials to achieve this polarity selection. Firstly, considering the internal references, the relay K1 is in the normally closed position and the –5 V from M40 is fed to the input of unity gain inverting amplifier M41 to produce the +5 V reference at the output. The +5 V reference via D15 allows

Q20 to switch on, this puts a LOW (0 V) at pin 9 of NAND gate M42 and a HIGH (+15 V) via INVERTOR M43 (pins 9 to 10) at pin 6 of second NAND GATE M42. The output of the first NAND gate M42 (pin 10) is thus held HIGH irrespective of the logic level at pin 8. Meanwhile, the HIGH at pin 6 of the second NAND gate M42 enables that gate to invert whatever logic level appears at pin 5. Similarly, the HIGH from pin 10 is fed to the input pin 12 of a NAND gate M42 which enables that gate to invert the logic level at its other input pin 13. Thus, overall from TP9 to TP10 three logic inversions occur, that being equivalent to a single inversion. As explained in paragraph 1.3.1.4, a HIGH (+15 V) at TP10 selects Q6, and a LOW (0 V) selects Q7 to switch the appropriate reference during the REF period.

If now external reference is selected, relay K1 connects to the normally open contact, and whatever voltage is present at the EXT REF socket passes via the X5 inverting buffer amplifier through the relay K1 to F.E.T. switch Q7 and via the unity gain inverting amplifier to Q6. If, for example, the external source is +1 V, then –5 V appears at Q7 and +5 V at Q6, just as if the circuitry were operating normally with an internal reference. Now if the polarity only of the external source is changed then +5 V is present at Q7 and –5 V at Q6. But the –5 V at Q6 now via D15, turns OFF Q20 which presents a HIGH to one input (pin 9) of the first NAND gate, this enables the gate to invert whatever logic level appears at the other input (pin 8). In addition the HIGH from Q20 collector via INVERTER M43 (pins 9 and 10) places a LOW at pin 6 of the second NAND gate M42 forcing a HIGH at its output (pin 4) irrespective of the level at pin 5. The HIGH now present at pin 13 of the third NAND gate M42 enables this gate to invert the level from pin 10 of the second NAND M42. Consequently, there are now from TP9 to TP10 four stages of inversion, being equivalent to non-inversion overall. Summarizing, the external reference having changed polarity means that whereas previously for a positive input signal, F.E.T. switch Q7 was selected, now for a positive input signal Q6 is selected. But, checking back, after the external reference polarity was reversed, –5 V was present at Q6. Therefore, the circuit has still selected the correct reference polarity to ensure satisfactory operation.

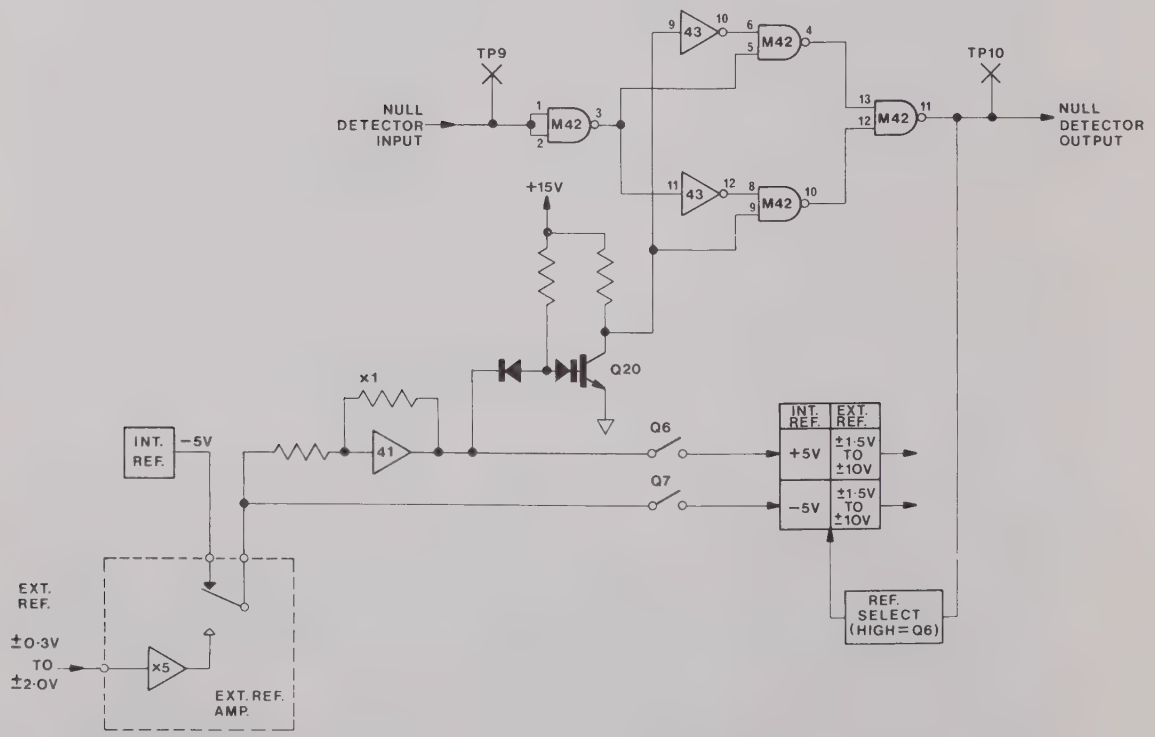


FIG. 1:14 EXTERNAL REFERENCE SWITCHING

1.3.2 DIGITAL SECTION

1.3.2.1 General Principles

Block diagram Fig. 1:15 outlines the essentials of the digital section and should be used with diagram 1:16 in order to follow the operation of this section.

The function of this section of the circuitry is to generate the timing pulses that when transferred to the analogue section , control the sequence from RESET to SIG to REF and back to RESET. Concurrent with this sequence, clock pulses are accumulated in a digital counter such that when the sequence is in the REF period, the number of clock pulses entering the counter is proportional to the length of that REF period, which is in turn proportional to the measured input signal. At the end of each reading cycle the count is stored and fed to the displays.

1.3.2.2 Command

To instruct the control logic to take a reading a COMMAND pulse is necessary ar the Command enable flip-flop M21. COMMAND can be generated either internally by the Read rate astable M27 providing for 3 readings/sec, or the front panel MANUAL switch (if HOLD is selected for single shot readings) or externally via the rear panel BCD socket for systems use. An extended command signal passes via the DELAY monostable and is delayed by a period appropriate to the function DC, AC or OHMS with or without FILTER, to allow adequate settling time of the analogue circuitry before taking a reading. When a COMMAND is received the Command enable flip-flop changes state which inhibits further Commands and admits 500 KHz clock pulses from the line locked clock to the least significant digit decade counter M9 and the cascaded decade counters M4.

1.3.2.3 Counter, Latches and Multiplexing

M4 is a large scale integrated circuit which contains the main counter and store (four full decades, one overrange latch and one overload latch) and also provides a multiplexed BCD output of the count stored in the four decade latches. The fifth decade counter M9 (least significant digit) is stored by M6 and its BCD output is introduced onto the multiplexing lines every fifth step pulse from the multiplex oscillator M19, by the logic 4 pole 2 way changeover switch M3. The multiplexed lines are decoded by M2 to produce data in seven segment format.

Before a COMMAND is received and until a subsequent TRANSFER pulse arrives, the stored count from the previous reading is multiplexed out to the display, the multiplexing frequency being approximately 1 KHz. The most significant digit (indicating a count of 100,000 or greater) is not multiplexed but is stored by M13 and fed directly to the most significant digit display.

1.3.2.4 Master Preset

Coincident with the first clock pulse after a COMMAND a MASTER PRESET pulse (approximately 2 μS) is generated and is fed to M4. This sets the 4 decade counters to all zero's and the binary overrange and overload latches to 1's (equivalent to a count of 30,000). The least significant decade M9 although receiving clock pulses is not allowed to count but is held preset at a count of 9.

1.3.2.5 Signal Integrate Period

A summary of the states of the counters during one reading cycle is shown in Fig. 1:17. As mentioned, following a MASTER PRESET pulse 1's appear at the overrange and overload latch outputs of M4 and remain in this state until a further 10,000 clock pulses have been counted when the clock resets to 00,000. At 500 kHz, 10,000 clock counts define a period of 20 mS and this period is used to determine the SIG period. At 30,000 a Start sig timing pulse is sent to the analogue section via T3 and after another 10,000 clock pulses a step pulse is sent via T2, this terminates the SIG period and starts the REF period.

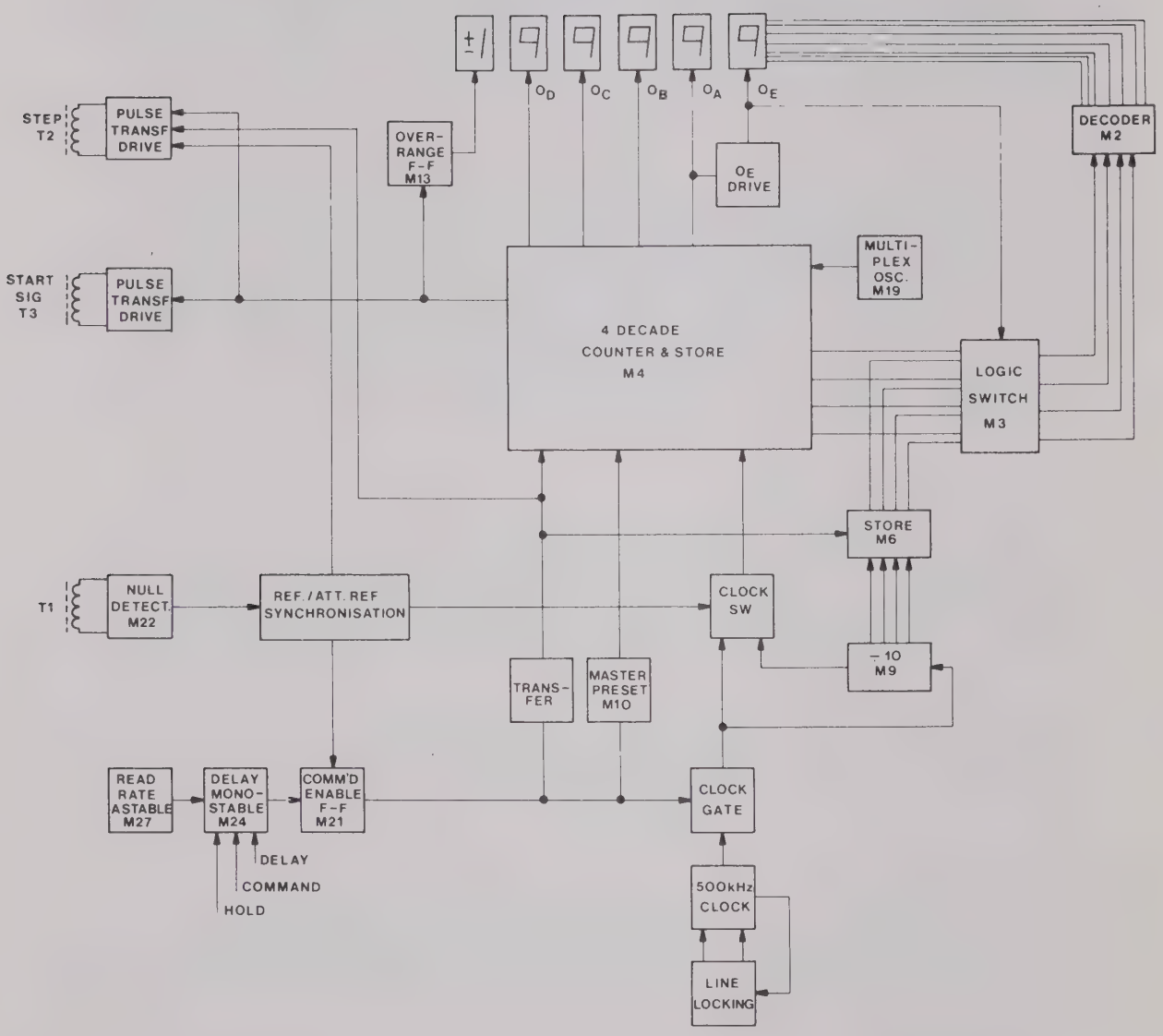


FIG. 1:15 SIMPLIFIED DIAGRAM OF DIGITAL SECTION

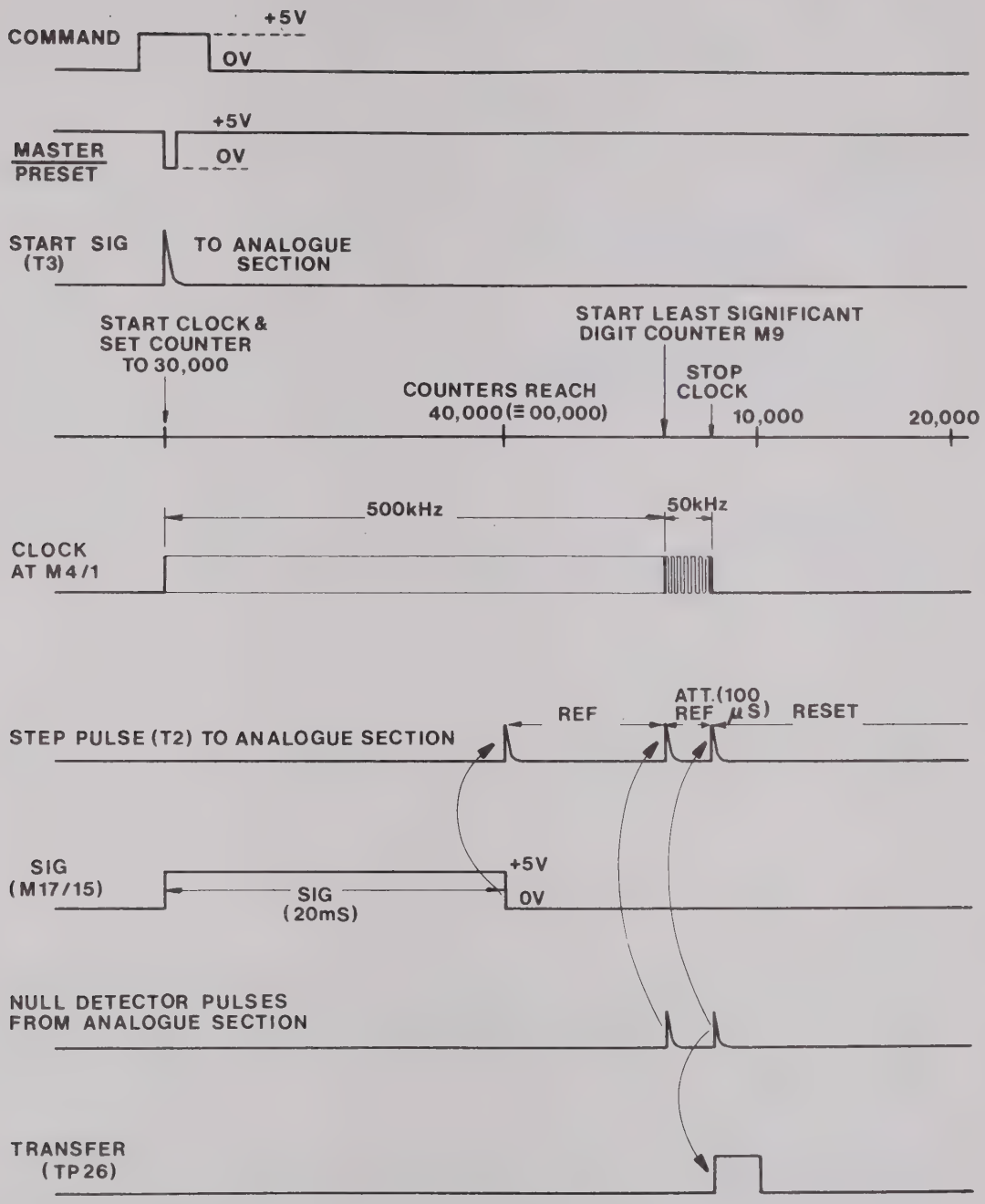


FIG. 1:16 DIGITAL SECTION TIMING DIAGRAM

1.3.2.6 **Reference Integrate Period**

During the REF period the clock pulses continue to accumulate in the M4 counters, M9 still being held at 9, until a null detector pulse is received from the analogue section via T1. This pulse is stored by M16 flip-flop which removes the hold on the least significant digit counter M9. In synchronism with the next clock pulse the clock input to M4 is switched from the 500 kHz clock to the output of M9 (50 kHz) and a step pulse is sent via T2 to the analogue section to start the attenuated REF period.

Clock pulses now feed the five cascaded decade counters M9 and M4 until the second null detector pulse appears at T1. This pulse is used to reset the state of the Command flip-flop M21 enabling further commands to be accepted, and the 500 KHz clock to the counters is gated out preventing further accumulation of clock pulses.

	SUMMARY OF COUNTER SEQUENCE	MOST SIGNIF. DIGIT (BINARY)	DECADES	CLOCK TO M4	LEAST SIGNIF. DIGIT	CLOCK
READING FROM PREVIOUS CYCLE		01	4573		6	CLOCK STOPPED
START SIG.	COMMAND PRODUCES MASTER PRESET WHICH SETS 30,000 AND HOLDS LEAST SIGNIFICANT DIGIT AT 9	11	0000	500kHz	9	START CLOCK 500kHz
END SIG.	AFTER 10,000 CLOCK PULSES (≙20mS) COUNTER AT 00,000 (≡40,000) LEAST SIGNIF. DIGIT STILL HELD AT 9	00	0000	500kHz	9	500kHz
START REF.	1 CLOCK PULSE LATER	00	0001	500kHz	9	500kHz
FIRST NULL DETECTOR PULSE	COUNTER HAS REACHED, FOR EXAMPLE:	01	4562	500kHz	9	500kHz
START ATT. REF.	1 CLOCK PULSE LATER	01	4563	50 kHz	0	500kHz
FINAL READING	SECOND NULL DETECTOR PULSE STOPS CLOCK & PRODUCES TRANSFER	01	4568		2	STOP CLOCK

FIG. 1:17

1.3.2.7 Transfer

When the COMMAND enable flip-flop is reset by the second null detector pulse, a TRANSFER pulse is generated by M21 to instruct the counter latches M4 and M6 to store the new count, which is then multiplexed out to the displays. Coincident with the TRANSFER pulse a third step pulse is passed via T2 to the analogue sector to start the RESET period. Both the analogue and digital sections remain in this state until the next COMMAND pulse arrives.

1.3.2.8 The Line Locked Clock

For optimum rejection of mains borne interference in the analogue circuitry it is important that the SIG period is an exact multiple of the line period (normally 20 mS). As the line frequency (nominally 50 Hz) is subject to small variations, the high rejection obtained is only preserved by changing the SIG period accordingly. To achieve this, the 500 KHz clock frequency is changed in sympathy with line frequency variations, commonly called 'line locking'.

Block diagram Fig. 1:18 shows the line locking network. A sample of the line frequency is shaped into a line frequency square wave by M29.

This square wave is passed to ÷ 2 flip-flop M30 to produce an approximately 25 Hz output.

The clock used to feed the counters in the digital section consists of an astable oscillator Q44 and Q45 with a nominal frequency of 500 KHz. It is provided with additional circuitry such that a logic level at one of two inputs (TP20 or TP21) can increase or decrease this frequency by about 1%. The application of either of these FAST/SLOW signals turns on either Q48 or Q49, thus charging or discharging capacitor C112 via R119. The voltage

on C112 is buffered by Q46 and Q47 and appears on capacitor C111 (TP22). The longer the fast or slow signals are applied, then the further the control voltage at TP 22 will drift and this change varies the discharge rate of timing capacitors C109 and C110 and thus effects the required change in frequency.

The nominal 500 KHz from the clock oscillator is fed to a ÷ 10,000 counter. This counter is held in reset by the high state of the 25 Hz square wave mentioned before. When the 25 KHz changes to a low the ÷ 10,000 divider starts counting. After 10,000 clock pulses an output appears from the counter and is stored by M30, this is fed to the logic changeover switch M32. This switch is changed over when the 25 Hz square wave returns to a high state. This means that depending upon the frequency of the clock being high or low, the output of the ÷ 10,000 counter arrives at the changeover switch early or late respectively. If the output of M30 is produced early, then a logic high state appears at TP21 and remains until the switch changes over. If the switch changes over before the output of M30 has changed then a FAST logic level appears at TP20 and remains until the output of M30 does change.

In this way, the frequency of the clock is changed up or down to correspond with line frequency changes. It should be noted that although the maximum duration of the SLOW/FAST signals is 20 mS, in practice once the clock has 'line locked' after switch on (approximately 3 mins) the SLOW/FAST signal duration is typically 5 μS. This means that any change in clock frequency taking place whilst a reading cycle is in progress introduces a negligible error in the displayed reading.

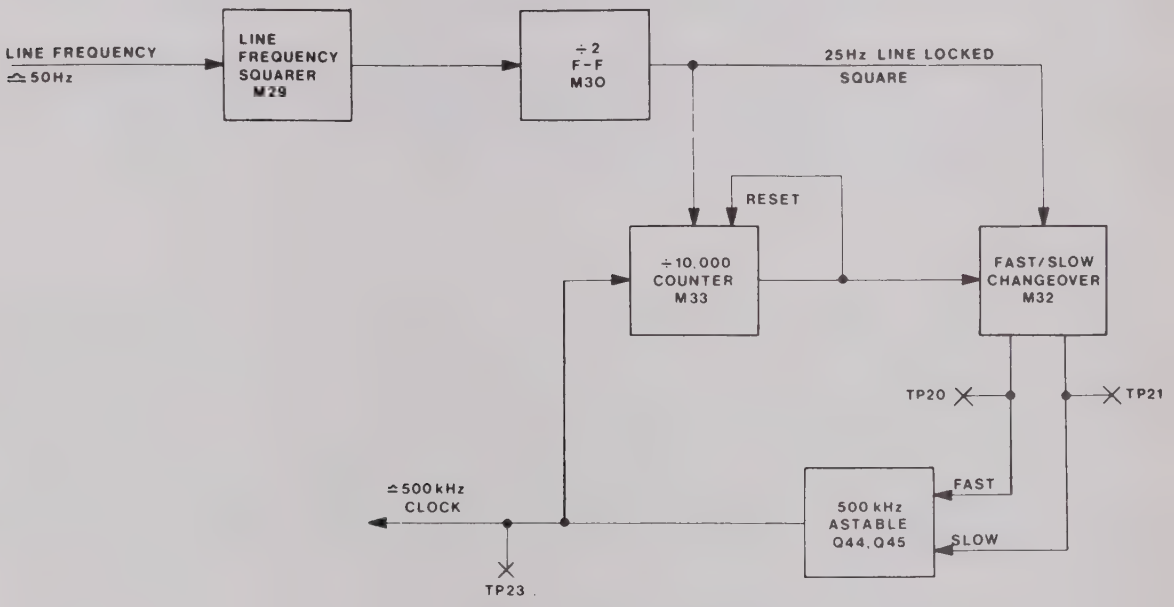


FIG. 1:18 LINE LOCKING BLOCK DIAGRAM

1.3.2.9 External Control

The internal commands from the read/rate astable may be inhibited by the $\overline{\text{HOLD}}$ external signal (via the BCD connector or front panel switch). A reading is then initiated by generating a command via the $\overline{\text{COMMAND}}$ BCD control line of the front panel MANUAL switch. This is routed via the Delay Monostable, M24. A logic '0' on the $\overline{\text{DELAY}}$ control line will automatically insert a delay equal to the settling time of the analog circuitry.

1.3.3 Power Supplies

1.3.3.1 General

The mains transformer and power supply components are situated along the right hand side of the Analogue–Digital board when viewed from the front. Transformer T4 is of toroidal construction with a split primary comprising two 115 V windings. These are intended for either series or parallel connection, depending on the line voltage. An earth screen is interposed between primary and secondary windings to minimise electrostatic coupling, this is grounded to line earth. Entirely isolated from the earth screen and all windings is a further electrostatic screen fitted to act as a Guard Screen.

1.3.3.2 +15V, –15V and +5V Supplies

Mains Transformer T4 has three secondary windings each with its separate bridge rectifier and solid-state regulator. Outputs from M47 and M48 are connected in series to provide DC supplies required for the entire analogue circuitry throughout the instrument. These regulators are capable of 500 mA output.

The third regulator M50 produces the +5 V DC supply, which is used to power all the logic circuitry in the instrument and the DC inverter for the +180 V Sperry supply. This regulator is capable of 1 ampere output and all regulators include foldback current limiting and thermal shut-down, to provide short circuit protection.

1.3.3.3 +180V and –8V Supplies

The +180 V supply is required for the seven segment cold cathode (Beckman) displays, and the –8 V for the VGG supply to PMOS integrated circuit M4, and the line locking circuitry.

The +180 V is produced by a DC to DC converter stepping up from the +5 V supply. Transistors Q40, Q41 form an astable multivibrator driving Q42 which switches the centre tap of the primary of the step-up transformer T5 to 0 V at approximately 12 KHz. One side of the primary is connected via L1 to +5 V and the other half of the primary acts as an auto-transformer to produce a voltage switching from +5 V to –5 V.

When this voltage is +5 V capacitor C106 charges through R107 and D32, when the transformer voltage switches to –5 V, C106 being already charged to 5 V produces – 10 V as its negative terminal. Capacitor C107 then charges through D31 from C106. After several switching cycles the negative voltage at C107 builds up and is limited to –8.2 V by Zener Diode D33. The secondary produces a high voltage square wave which is rectified and smoothed by W4 and C108.

1.3.4 Display

The Display comprises seven segment cold cathode (Beckman) digits operating from a 180 V DC supply line. The complete assembly is mounted on the front of the A–D assembly and at right angles to it. The segment drive lines from the decoder driver on the A – D pass via the soldered right angle connector directly to the pins on the displays. The five decade displays are multiplexed by the anode switches Q1 to Q5, the seven segments of each decade being connected in parallel and taken to the decoder driver M2 on the A – D assembly. The decimal points DP2 to DP4 are driven by Q10 and multiplexed by Q1 to Q3 with the decade displays. The decimal point DP1, the overrange digit and the + and – indicators are multiplexed in parallel with the two least significant decades by Q4 and Q5. The inputs to the anode switches Q1 – Q5 are AC coupled from M1 buffer which is fed from M4 on the A – D assembly. The function indicators V, mV, MΩ, kΩ, Ω and EXT REF are incandescent long life lamps again driven by signals from A – D assembly.

1.3.5 External Reference (Ratio)

Under normal operation the references for the analogue to digital converter are provided internally on the A – D P.C.B, and an option is available for using an external reference when required. The external reference may be in the voltage range 0.3 V to 2.0 V and be of either polarity, as internal circuitry senses the polarity of both signal and reference inputs and enables 4 quadrant ratio measurements to be made.

The use of an external reference enables ratio measurements of VDC/V EXT REF, AC/EXT REF and OHMS/V EXT REF to be made.

Provision is made for switching to an external reference by operating the 'EXT REF' switch on the rear panel, or with remote programming pin 7, when the rear panel switch is in the 'INT REF' position. When an external reference has been selected either by the rear panel switch or remote programming, a logic signal EXT REF is available at the BCD output socket, pin 25 and EXT REF shows in the front panel display.

The external reference voltage should be connected to the 'EXT REF INPUT' socket.

For valid ratio measurements a X5 voltage gain is required between the external voltage reference and the voltage presented to the converter integrator (to match the X5 gain in the signal path provided by M34 on the A – D P.C.B.).

The external reference amplifier, the essential features of which are shown in Fig. 1:19, provides X5 gain and presents a high impedance to the external voltage.

Amplifier M1 and M2 are used in the non-inverting configuration producing a high input impedance. Amplifier M3 produces a differential input to single ended output conversion and gives an overall gain of X5.

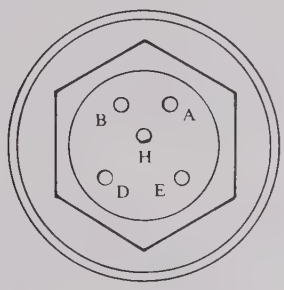
The switching of internal to external reference is achieved using relay K1.

Pin Connections as seen from rear.

E = Input Hi

D = Input Lo

H = Analogue Common



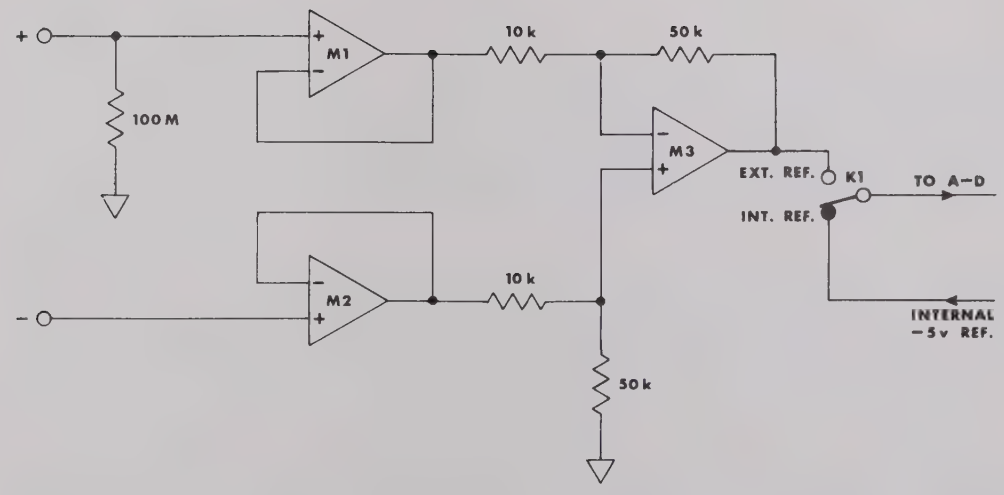


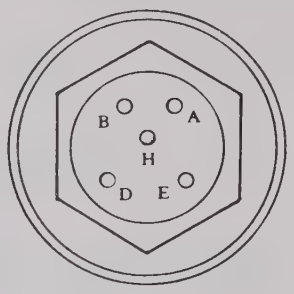
FIG. 1:19 EXTERNAL REFERENCE AMPLIFIER

An alternative ratio option is available for a 3V to 20V and 30V to 200V external reference. In this case the overall gain to that external reference is x.5 and x.05 respectively, as opposed to x5 for the 0.3V to 2.0V version. Otherwise operation is as for the low voltage reference version.

Pin connections seen from rear.

10V/100V
external reference range

A – Input Hi 10V
B – Input Lo 10V
D – Input Lo 100V
E – Input Hi 100V
H – Signal input Lo



SECTION 2

MAINTENANCE

2.1 INTRODUCTION

2.1.1 General

Regular maintenance of the instrument will enable the user to have confidence in measurements made as well as ensuring the highest accuracy possible.

Normally this will consist of checking the calibration at, or before, the end of the guaranteed specification validity period and adjusting where necessary.

Section 4.2 of the Operating Manual gives a routine for checking the instrument is working within its specified accuracy and may be used as the first stage of an instrument check.

Any readings found to be grossly out of specification should be treated with suspicion as they may indicate a fault.

A routine calibration procedure is given in Section 2.2 of this manual.

Before attempting any calibration it must be ensured that the test equipment is of sufficiently high accuracy. The test equipment required is specified in Section 2.2.2. It is also recommended that Section 1, Technical Description, be read before commencing, in order that some idea may be gained of the purpose and possible interaction of the various adjustments.

The circuit diagrams and printed circuit board layouts are contained in Section 4 of this manual.

In case of difficulties or for general advice in servicing your instrument, do not hesitate to contact our Customer Service Department. (For the address and telephone number, see the front of this manual).

2.1.2 Removal of Covers – Access for Calibration or Repair

Access to the interior of the instrument for routine calibration, or repair, is achieved by removing the four screws securing the top cover, two screws at each side, and lifting the cover clear of the instrument. Removal of the bottom cover is achieved in an identical manner. The top cover provides access to the Analogue to Digital Converter, the DC Isolator and the External Reference option. The bottom cover provides access to the AC and Resistance Options and BCD Output option. With both covers removed the instrument is still operational, may be inverted without component damage and full mechanical rigidity is maintained during servicing operations.

NOTE: The front panel terminals are insulated from the instrument case, enabling the internal circuitry to float at potentials greater than earth, so the potential of the internal Guard Shields can also reach dangerous levels. In addition, mains supplies appear on exposed conductors in the instrument. Therefore great care should be taken when handling an instrument with covers removed if the input terminals are connected to an external source or the mains supply is connected.

Access to the Display Board is achieved by removing the front panel. Disconnect the mains supply to the instrument and any connections to the input terminals. Remove the top and bottom covers as described in previous paragraph. Disconnect all internal leads from the input terminals. Remove the four screws fastening the front panel to the side panels, two screws each side, and the nuts from the studs on the front panel which pass through the centre screen. Draw the front panel forward until it clears the switches and remove the front panel to gain access to the Display Board (it should not be necessary to disconnect the 'power' switch).

2.2 ROUTINE CALIBRATION

2.2.1 General

The following section contains a calibration procedure which should be carried out at the end of the Specification Validity period, as stated in Section 4.1.1 of the Operating Manual, or when the instrument is found to be out of specification.

Routine calibration should be completed at an ambient temperature of $23^{\circ}C \pm 1^{\circ}C$ if the instrument is to meet its specification over the given operating range. Before commencing calibration allow 2 hours 'warm up' at this temperature with the upper and lower covers fitted in position but not fastened in place. The guard screens covering the boards should be left undisturbed throughout calibration

For the greatest accuracy and for the minimum time spent calibrating, it is necessary for the boards to remain at their correct working temperature throughout a recalibration. Allow at least two hours warm up before commencing calibration. The top and bottom covers should be left in position whenever possible except when the actual adjustments are being made. AC, Voltage and Ohms options are initially calibrated with the instrument turned over. After the calibration procedures have been followed through, the instrument should be left the correct way up with the covers on for at least an hour for the internal temperature to stabilise again. If the calibration procedure is now repeated, it will be possible with relatively few adjustments to bring the instrument to optimum calibration.

Calibration of functions should always be in the sequence given

2.2.2 Test Equipment Required

Test equipment specifications for fault finding, calibration and performance verification are given below. Generally, calibration sources should only be used where the accuracy specification exceeds that of the instrument by a factor of at least 4.

2.2.2.1 DC Calibrator

DC Calibration Source: Accuracy .001% or better,

e.g., Julie Research DVS 106.

Precision 100:1 attenuator, ratio accuracy better than 10 ppm, nominal impedance 10 kΩ – 100 kΩ. (This is needed where the calibration source does have the required accuracy at 100 mV and 10 mV).

2.2.2.2 DC Voltmeter

High sensitivity, fully floating DVM or null detector capable of resolving 10 μV.

NOTE: (This is only required when Analogue Output option A01 is fitted).

Otherwise a meter capable of measuring 1 Volt ± ½ Volt.

2.2.2.3 AC Calibrator

Precision AC source capable of 0.02% accuracy at L.F. and 0.05% at 100 KHz. Ranges 10 mV to 1000 V.

NOTE: This is only required if option 01 or 11 is fitted.

2.2.2.4 Crest Factor Signal

A calibrated assymetric crest factor signal of magnitude approximately one volt to an accuracy of 0.02%.

NOTE: This is only required if option 01 or 11 is fitted. If it is not available the relevant steps in the calibration procedure may be omitted, the effect being a possible loss in accuracy for high crest factor signals.

2.2.2.5 **Precision Resistors**

A set of resistance standards 100Ω to 10MΩ in decades, the 100Ω and 1 kΩ to be 4 terminal resistors. Calibrated accuracy better than .001% up to 1 MΩ, .01% at 100 MΩ.

NOTE: These are only required if option 03 is fitted.

2.2.3 **Procedure**

2.2.3.1 **General**

Read Section 2.2.1 before proceeding.

Abbreviations:	TP	–	Test Point.
	w.r.t.	–	with respect to.

2.2.3.2 **DC Voltage Calibration**

A – D Converter Board Assembly – Drawing No. 400094.
DC Isolator Board Assembly – Drawing No. 400087.

If the instrument is fitted with an analogue output (option A01), it is necessary to calibrate the DC isolator for correct analogue output and then calibrate the A – D converter for correct displayed readings. If an analogue output is not fitted and the instrument is undergoing routine recalibration, steps 4, 5 may be omitted, these adjustments being made on the digital board instead (steps 6, 9).

DC Voltage calibration involves adjustments on both boards referred to above. The following procedure is divided into sub sections, the titles of which indicate to which board the component designators contained within that section refer.

For all the following adjustments – DC Mode and Filter should be selected.

1. Line-locking adjustment. Connect an external DVM between logic 0 V (located between integrated circuits M14 and M15) and TP22, both on the digital board. Adjust R112 for a voltage of –1 Volt ± ½ Volt at this point. Note there is a long settling time associated with this adjustment.

Preliminary DC Isolator board adjustments.

2. Select 100mV range and connect a 10 megohm resistor between Hi and Lo. Note the reading is noisy and takes time to settle. Adjust R65 for less than 200 μV displayed (= 20 pA input current).

3. Leave on 100mV range, and short input. Adjust R75 (Front Panel mV offset adjust) for zero displayed.

Steps 4 and 5 apply only if an analogue output option is fitted.

4. Switch to 10 V range and connect null detector or DVM between analogue output Hi (or TP3) and input Hi. Adjust R75 for null or zero (± 30 μV).

5. With the null detector or DVM connected as before (step 4), switch to 1 V range and apply +1 Volt. Adjust R69 for null or zero ± 30 μV. Check with –1 Volt applied. The null detector may now be removed as the analogue output is calibrated.

Analogue to Digital Board scale adjustments.

6. With instrument on 10 V range and input shorted, adjust R82 for zero (bouncing polarity) on display.

7. Select 10 V range and apply +10 mV. Adjust R46 (100 dig. pot) for +100 digits displayed.
NOTE: Earlier instruments do not have R46 fitted. Here adjustment for both 10 and 100 digits is effected by potentiometers R80 and R81.

8. Apply +1 mV. Adjust R80 for 9 bouncing to 10 digits displayed. Apply –1 mV and adjust R81 for a similar display.

9. With +1 Volt applied on the 1 Volt range, adjust R76 for +1.00000 Volt (± 1 digit) displayed. Apply -1 Volt and adjust R78 for a -1.00000 Volt (± 1 digit)

DC Isolator board full range adjustments.

10. Select 10 V range. Apply +10 Volts and adjust R70 for +10.0000 (± 1 digit) displayed Check -10 Volts reads correctly.

11. Check inputs of +19 Volts and −19 Volts are displayed correctly (± 4 digits).

12. Select 100 V range. Apply +100 Volts. Adjust R71 for 100.000 (± 1 digit) displayed. Check for -100 Volts applied.

13. Select 1000 V range. Apply +1000 Volts. Adjust R72 for +1000.00 (± 1 digit) displayed Check for −1000 Volts applied.
(Note: Take care that>500 V pk is not applied between signal Lo and earth).

14. Select 100 mV range. Apply +100 mV and adjust R67 for +100.000 (± 1 digit) displayed. Check for −100 mV applied.

15. Select 10 mV range. Apply plus and minus 10 mV and adjust R68 for a total span of 20.0000 mV (± 1 μV) e.g. +9.9990 and −10.0010 mV. Repeat until span is correct. This procedure is necessary due to thermal E.M.F.'s which can be nulled out with the front panel mV offset control if desired.
Note: There is a long settling time associated with this adjustment.

The DC isolator board and digital board are now calibrated.

2.2.3.3 AC Voltage Calibration (Options 01 and 11)

AC Converter Board Assembly – Drawing No. 400037.

In general it will be necessary to proceed through all the steps below. However, if the instrument is within specification for applied inputs of zero, 1 mV, 10 mV, 100 mV on the 10 V range, steps 1 – 8 may be omitted.

On the AC Converter options in particular various controls interact and the adjustments must be carried out in sequence.

Important
An AC calibration is normally done after the basic DC instrument has been calibrated. If it is intended to calibrate the AC option without first fully calibrating the DC, steps 1 – 9 in the DC Calibration procedure at least must be followed.

Before proceeding, ensure the introductory notes on the calibration procedures have been read.

For all the following adjustments AC Volts and Filter should be selected.

1. Select 10 V range and short input. Turn R98 and R115 fully clockwise and R109 fully anticlockwise.

2. Gradually turn R109 clockwise until between 30 and 40 digits are displayed. Do not pass through zero.

3. Turn R115 anti-clockwise until display starts to oscillate, and then rotate slowly clockwise until oscillations just stop. On some instruments a 'catching diode' has been fitted to inhibit the oscillation. If there is no oscillation sense TP9 with an oscilloscope and adjust R115 until TP9 is zero ± 200 mV. (TP9 is located immediately below R70).

4. Turn R109 slowly clockwise until display shows .0000 (± 5 digits).

5. Apply 10 mV 500 Hz, and adjust R98 for a display of .0095 ± 4 digits.

6. Adjust R36 for minimum reading (if zero, re-adjust R98 and repeat adjustment of R36).

7. Re-adjust R98 for .0095 (± 4 digits)

8. If the input is now shorted again the display should indicate between 0 and 15 digits for an 01 option, or up to 25 digits for a 11 option. (If not, steps 1 – 7 should be repeated).

Full Range Adjustments.

Each range on the converter is adjustable in gain by a variable resistor and a parallel trimming capacitor. The ranges are calibrated for a full range input signal at the two nominal frequencies 500 Hz and 50 kHz. By noting the readings at other frequencies, i.e. 50 Hz, 5 kHz, 20 kHz and 100 kHz, and by checking the accuracy specifications for the instrument at these frequencies an improved frequency response may be obtained for further minor adjustments.

Note there is a single gain control, R67, for the converter which adjusts full range on all ranges equally. This can be used whenever all ranges are found to be either high or low. Otherwise ranges should be adjusted individually and in sequence as detailed below. R67 should be approximately in the centre of its travel before proceeding.

Adjustments below should be made until the reading is within 10 digits of nominal.

9. Switch to 1 Volt range and apply 1 Volt at 500 Hz. Adjust R16 for correct reading.

   NOTE: If a high crest factor signal is not available, Steps 10 and 11 may be omitted, the effect being a possible loss of accuracy for high crest factor signals.

10. Apply crest factor signal as previously described.
    Note output when pulses are –VE going at input. Reverse the input and adjust R61 for a similar reading with +VE going pulses (± 10 digits).

11. Calibrate the high crest factor signal using R70. Re-check step 9 and repeat calibration of R70 until both are correct.

12. Apply 10 V 500 Hz, 10 V range. Calibrate using R18.

13. Apply 10 V 50 kHz. Calibrate using C15.

14. Reduce frequency to 5 kHz and check that the reading is within ± 20 digits of nominal. If not it will be necessary to move the wire joining R4 and R5; making it more 'earthy' will bring down the reading at 5 kHz. Repeat step 13 and re-check. This should only be necessary after component replacement.

15. Apply 1 V 50 kHz, 1 V range. Calibrate using C13.

16. Reduce the frequency to 5 kHz and adjust twisted pair capacitor C55 to bring output to within 20 digits of nominal (closer coupling will increase the reading). This can be adjusted without removing the guard shield by varying the capacitance of the coupled wire capacitor, accessible with a screwdriver through the guard shield holes. Repeat step 15 and re-check. This should only be necessary after component replacement.

17. Apply 100 V 500 Hz, 100 V range. Adjust R9 for correct reading.

18. Apply 100 V 50 kHz. Adjust C6 for correct reading.

The following steps apply to 01 options only:

19. Apply 100 mV 500 Hz, 100 mV range. Adjust R26 for correct reading.

20. Apply 100 mV 50 kHz. Adjust C20 for correct reading.

21. At this point the 1000 V range can be checked for full range signals. There are no adjustments but both the 10 V and 100 V adjustments have some effect.
    N.B. Take care that >500 V pk is not applied between Lo, guard and earth. Also ensure that the maximum gain bandwidth product is not exceeded, e.g. 20 kHz at 1000 Volts.

The AC Converter is now calibrated.

2.2.3.4 Ohms Converter Calibration (Option 03)

Converter Board Assembly – Drawing No. 400089.

Important
An ohms board calibration is normally done after the basic DC instrument has been calibrated. If it is intended to calibrate the ohms option without first fully calibrating the DC, steps 1 – 9 in the DC calibration procedure at least must be followed.

Before proceeding ensure the introductory notes on the calibration procedures have been read.

Throughout the following adjustments OHMS and FILTER should be selected unless otherwise stated.

The lower ohmic value resistance standards (100Ω, 1kΩ) should be connected in the normal manner for 4 wire measurements whereas the higher values may be connected for 2 wire measurement. Ensure the 2 wire – 4 wire switch on the instrument is in the relevant position.

Before proceeding re-check step 3 in the DC voltage calibration procedure.

1. Select 4 wire on the 2 wire – 4 wire switch and apply a 4 wire short to the input terminals. This may most simply be done by connecting together I+, Hi, and Lo.
   Select 100Ω range. Adjust R55 on the ohms board for .0000 displayed.

2. Select 100Ω range and connect 100Ω resistance standard. Adjust R50 for 100.000 (± 2 digits) displayed.

3. Leave the 100Ω resistance standard connected and insert a 100Ω resistor (± 5%) in series with the I-lead. Adjust R49 for 100.000 (± 3 digits) displayed.

Repeat steps 2 and 3 until the displayed reading is correct in both cases.

4. Select 1kΩ range and connect the 1kΩ standard. Adjust R52 for 1.00000 (± 2 digits) displayed.

5. Select 10kΩ range and connect the 10kΩ standard. Adjust R53 for 10.0000 (± 2 digits) displayed.

6. Select 100kΩ range and connect the 100kΩ standard. Adjust R54 for 100.000 (± 2 digits) displayed.

7. Select 1MΩ range and connect the 1MΩ standard. Adjust R51 for 1000.00 (± 4 digits) displayed.

8. Select 10MΩ range and connect the 10MΩ standard. Note the reading will appear noisy and may take time to settle. Adjust R59 for 10.0000 (± 30 digits) displayed.

9. Repeat steps 7 and 8 until both are correctly adjusted.

The Ohms converter is now calibrated.

2.2.3.5 External Reference (Ratio) Calibration (Option R03)

Ratio amplifier (1V I/P) board assembly – Drawing No. 400091.
A – D Converter board assembly – Drawing No. 400094.

Polarity Quadrant definitions:–

Quadrant 1 – positive signal, positive external reference
2 – positive signal, negative external reference
3 – negative signal, positive external reference
4 – negative signal, negative external reference

1. Select External Reference on the rear panel slide switch. Select 1, DCV, Connect the DC Calibrator to the voltage input terminals on the front panel of the instrument and the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 1 when positive signal is applied.

2. Apply +0.3 V and –0.3 V alternately (i.e. from quadrant 1 to 4) and adjust R24 (on the External Reference Board) to obtain the same reading on the display ± 2 digits for both quadrants (allow adequate settle time when changing quadrants).

3. Apply +2 V and adjust R14 (on the External Reference Board) for a reading on the display of 1.00000.

4. Connect the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 2 when a positive signal is applied. Select External Reference.

   Apply +0.3 V and –0.3 V alternately (i.e. from quadrant 2 to quadrant 3) and adjust R79 ('Ref Zero' on the A – D Converter Board) to obtain the same reading on the display ± 2 digits for both quadrants.

5. Select Internal Reference. Apply –1 V. Adjust R78 ('–1 V' on the A – D Converter Board) for a reading of –1.00000 ± ½ digit.

6. Select External Reference. Apply –2 V (i.e. in quadrant 3) and adjust R19 (on the External Reference Board) for a reading on the display of –1.00000.

7. Repeat steps 4 to 5 until the readings are correct without any further adjustment.

8. Repeat steps 1 to 6 until the readings are correct without any further adjustment.

This completes the calibration procedure.

2.2.3.6 External Reference (Ratio) Calibration (Option RO6)

Ratio amplifier ($\frac{10}{100}$ V I/P) board assembly – Drawing No. 400125

A – D Converter board assembly – Drawing No. 400094.

Polarity Quadrant definitions:–

Quadrant 1 – positive signal, positive external reference
2 – positive signal, negative external reference
3 – negative signal, positive external reference
4 – negative signal, negative external reference

1. Select External Reference on the rear panel slide switch. Select 10, DCV. Connect the DC Calibrator to the voltage input terminals on the front panel of the instrument and the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 1 when positive signal is applied.
2. Apply +3.0V and –3.0V alternately (i.e. from quadrant 1 to 4) and adjust R15 (on the External Reference Board) to obtain the same reading on the display ± 2 digits for both quadrants (allow adequate settle time when changing quadrants).
3. Apply +20V and adjust R5 (on the External Reference Board) for a reading on the display of 10.0000.
4. Connect the external reference 'Signal Inputs' to obtain a voltage ratio as defined by quadrant 2 when a positive signal is applied. Select External Reference.

   Apply +3V and –3V alternately (i.e. from quadrant 2 to quadrant 3) and adjust R79 ('Ref Zero' on the A – D Converter Board) to obtain the same reading on the display ± 2 digits for both quadrants.
5. Select Internal Reference & 1V range. Apply –1V. Adjust R78 ('–1V' on the A – D Converter Board) for a reading of –1.00000 ± ½ digit.
6. Select External Reference & 10V range. Apply –20V (i.e. in quadrant 3) and adjust R5 (on the External Reference Board) for a reading on the display of –10.0000.
7. Repeat steps 4 to 5 until the readings are correct without any further adjustment.
8. Repeat steps 1 to 6 until the readings are correct without any further adjustment.
9. Select quadrant 1 and apply +200V. Adjust R2 (on the External Reference Board) for a reading on the display of 100.000.
10. Select quadrant 3 and adjust R1 for a display of 100.000.
11. Repeat steps 9 and 10 until no further adjustments are necessary.

2.3 REPAIR AND COMPONENT REPLACEMENT

IT IS RECOMMENDED THAT THIS SECTION BE NOTED BEFORE UNDERTAKING ANY REPAIR.

A fault in the analogue circuitry will require the internal Guard Shields removing for access to the components and subsequent recalibration. Digital integrated circuits are fitted in sockets and can be replaced without disturbing the calibration of the instrument (although it is advisable to verify the performance after any component change).

The method of manufacture evolved by DATRON to ensure high reliability and stability involves elevated temperature 'burn-in' at both component and instrument level. In addition, operational amplifiers and other devices are selected for certain parameters. Hence many of the components used, although originally of a standard type, have a performance which can only be identified by a DATRON part number. These devices are held as stock items by DATRON who should be contacted if replacement is necessary.

Replacement of certain active devices and precision resistors also necessitates the re-selection of their associated F.S.V. [Factory Selected Value] resistors to accommodate component tolerances. These resistors, often high stability, metal film types are used to preset an offset or reference setting, usually with fine adjustment provided by an associated potentiometer. For information concerning the re-selection of F.S.V. resistors, the relevant sheets are available from DATRON.

Replacement of analogue components should be followed by recalibration of the relevant part of the circuit and details of these procedures are available from DATRON. Full routine calibration should then be carried out to ensure the instrument is within specification – if in any doubt consult our Customer Service Department.

When replacing semiconductor devices take great care to avoid overheating them during soldering. . . each joint being made as rapidly as possible. Although the use of a thermal shunt between semiconductor device and the soldered joint is strongly recommended, it is realised that it is impractical to use one in many instances. . .particularly when unsoldering a multi-lead device from a high density circuit board, a suction de-soldering tool is recommended.

When working on the isolator board, special consideration should be given to the effects of board leakage. Although active guarding is used extensively to reduce these effects, it should be borne in mind because of the high input impedance and sensitivity involved.

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	003223	22K 5% 2W CARBON			4
R2	003223	22K " "			—
R3	003223	22K " "			—
R4	003223	22K " "			—
R5	000823	82K 5% ¼w CARBON	MULLARD	CR25	2
R6	000103	10K " "	"	"	48
R7	000105	1M " "	"	"	4
R8	000103	10K " "	"	"	—
R9	011001	1K 1% ⅛w MF	HOLCO	HB	1
R10	440024	F.S.V. 1-10M 1% MF	"	"	2 of KIT
R11	440024	F.S.V. "	"	"	—
R12		NOT USED			
R13	011622	16K2 1% ⅛w MF	HOLCO	HB	1
R14		NOT USED			
R15		"			
R16		"			
R17		"			
R18	000106	10M 10% ¼w CARBON	MULLARD	CR25	8
R19	000106	10M " "	"	"	—
R20	000562	5K6 5% ¼w CARBON	"	"	2
R21	090009	75K .02% M/P W/W	MANN	3C-B	1 PAIR
R22	090009	9K1 " "	"	"	—
R23	011540	154R 1% ¼w CARBON	HOLCO	HB	1

NOTES.

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	090008	8K2 ·02% M/P W/W	MANN	3C-B	1 PAIR
R25	090008	75K " "	"	"	—
R26	000823	82K 5% ¼W CARBON	MULLARD	CR25	—
R27	000912	9K1 " "	"	"	1
R28	050017	7K5 ·1% ¼W MF	WELWYN	4033 D	1
R29	000106	10M 10% ¼W CARBON	MULLARD	CR25	—
R30	000106	10M " "	"	"	—
R31	000105	1M 5% ¼W CARBON	"	"	—
R32	000106	10M 10% ¼W CARBON	"	"	—
R33	090010	18K ·02% M/P W/W	MANN	3C-B	1 PAIR
R34	090010	2K " "	"	"	—
R35	011821	1K82 1% ⅛W MF	HOLCO	HB	1
R36	000106	10M 10% ¼W CARBON	MULLARD	CR25	—
R37	000100	10R 5% ¼W CARBON	"	"	1
R38	000103	10K " "	"	"	—
R39	000106	10M 10% ¼W CARBON	"	"	—
R40	000473	47K 5% ¼W CARBON	"	"	43
R41	000223	22K " "	"	"	3
R42	011002	10K 1% ⅛W MF	HOLCO	HB	2
R43	011302	13K " "	"	"	2
R44	011302	13K " "	"	"	—
R45	011002	10K " "	"	"	—
R46	000103	10K 5% ¼W CARBON	MULLARD	CR25	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R47	000103	10K 5% ¼w CARBON	MULLARD	CR25	—
R48	000683	68K " "	"	"	7
R49	000683	68K " "	"	"	—
R50	000273	27K " "	"	"	2
R51	000273	27K " "	"	"	—
R52	008007	10R 5% ⅓w CARBON	"	CR16	2
R53	008007	10R " "	"	"	—
R54	000104	100K 5% ¼w CARBON	"	CR25	34
R55	000104	100K " "	"	"	—
R56	000102	1K " "	"	"	5
R57 A–D	090005	2M475 x4 W/W .02% R	MANN	S9100	1 SET
R60	090005	99K95 " .02% R	"	"	—
R61	000476	47M 10% ¼w CARBON	ALLEN-BRADLEY	CB	1
R62	000105	1M 5% ¼w CARBON	MULLARD	CR25	—
R63	000105	1M " "	"	"	—
R64	000363	36K " "	"	"	1
R65	063502	5K POT CERMET	BECKMAN	72P	1
R66		NOT USED			
R67	063100	10R POT CERMET	BECKMAN	72P	1
R68	063200	20R " "	"	"	3
R69	063200	20R " "	"	"	—
R70	063200	20R " "	"	"	—
R71	063201	200R " "	"	"	2

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R72	063201	200R POT CERMET	BECKMAN	72P	—
R73	063104	100K " "	"	"	3
R74	063104	100K " "	"	"	—
R75	064105	1M POT 10 TURN CERMET	"	89P	1
R76	000102	1K 5% ¼w CARBON	MULLARD	CR25	—
R77	000102	1K " "	"	"	—
R78	000123	12K " "	"	"	2
R79	000123	12K " "	"	"	—
R80	000562	5K6 " "	"	"	—
R81	000107	100M 10% ¼w CARBON	ALLEN-BRADLEY	CB	2
R82	000107	100M " "	"	"	—
R83	011270	127R 1% ⅛w MF	HOLCO	H8	1
R84		NOT USED			
R85		NOT USED			
R86	000101	100R 5% ¼w CARBON	MULLARD	CR25	1
R87	000106	10M 10% ¼w CARBON	"	"	—
R88	000270	27R 5% ¼w CARBON	"	"	2
R89	000270	27R " "	"	"	—
R90	000222	2K2 " "	"	"	1
R91 — R100		NOT USED			
R58-R59		NOT USED			

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R101	000473	47K 5% 1/4W CARBON	MULLARD	CR25	—
R102	000473	47K " "	"	"	—
R103	000473	47K " "	"	"	—
R104	000473	47K " "	"	"	—
R105	000473	47K " "	"	"	—
R106	000473	47K " "	"	"	—
R107	000473	47K " "	"	"	—
R108	000473	47K " "	"	"	—
R109	000152	1K5 " "	"	"	6
R110	000152	1K5 " "	"	"	—
R111	000152	1K5 " "	"	"	—
R112	000473	47K " "	"	"	—
R113	000103	10K " "	"	"	—
R114	000473	47K " "	"	"	—
R115	000103	10K " "	"	"	—
R116	000473	47K " "	"	"	—
R117	000103	10K " "	"	"	—
R118	000473	47K " "	"	"	—
R119	000473	47K " "	"	"	—
R120	000473	47K " "	"	"	—
R121	000103	10K " "	"	"	—
R122	000103	10K " "	"	"	—
R123	000473	47K " "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No USED Per Assy
R124	000103	10K 5% 1/4W CARBON	MULLARD	CR25	–
R125	000473	47K " "	"	"	–
R126	000152	1K5 " "	"	"	–
R127	000152	1K5 " "	"	"	–
R128	000152	1K5 " "	"	"	–
R129	000103	10K " "	"	"	–
R130	000473	47K " "	"	"	–
R131	000473	47K " "	"	"	–
R132	000103	10K " "	"	"	–
R133	000473	47K " "	"	"	–
R134	000103	10K " "	"	"	–
R135	000473	47K " "	"	"	–
R136	000473	47K " "	"	"	–
R137	000103	10K " "	"	"	–
R138	000473	47K " "	"	"	–
R139	000473	47K " "	"	"	–
R140	000103	10K " "	"	"	–
R141	000473	47K " "	"	"	–
R142	000103	10K " "	"	"	–
R143	000473	47K " "	"	"	–
R144	000473	47K " "	"	"	–
R145	000473	47K " "	"	"	–
R146	000473	47K " "	"	"	–

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R147	000103	10K 5% 1/4W CARBON	MULLARD	CR25	—
R148	000103	10K " "	"	"	—
R149	000473	47K " "	"	"	—
R150	000473	47K " "	"	"	—
R151	000473	47K " "	"	"	—
R152	000473	47K " "	"	"	—
R153	000473	47K " "	"	"	—
R154 & R155	000473	47K " "	"	"	—
R156	000473	47K " "	"	"	—
R157	000473	47K " "	"	"	—
R158	000103	10K " "	"	"	—
R159	000473	47K " "	"	"	—
R160	000473	47K " "	"	"	—
R161	000103	10K " "	"	"	—
R162	000103	10K " "	"	"	—
R163	000103	10K " "	"	"	—
R164	000103	10K " "	"	"	—
R165	000103	10K " "	"	"	—
R166	000103	10K " "	"	"	—
R167	000103	10K " "	"	"	—
R168	000103	10K " "	"	"	—
R169	000103	10K " "	"	"	—
R170	000103	10K " "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R171	000103	10K 5% 1/4W CARBON	MULLARD	CR25	—
R172	000104	100K " "	"	"	—
R173	000104	100K " "	"	"	—
R174	000104	100K " "	"	"	—
R175	000104	100K " "	"	"	—
R176	000104	100K " "	"	"	—
R177	000104	100K " "	"	"	—
R178	000103	10K " "	"	"	—
R179	000103	10K " "	"	"	—
R180	000104	100K " "	"	"	—
R181	000104	100K " "	"	"	—
R182	000104	100K " "	"	"	—
R183	000104	100K " "	"	"	—
R184	000104	100K " "	"	"	—
R185	000103	10K " "	"	"	—
R186	000683	68K " "	"	"	—
R187	000683	68K " "	"	"	—
R188	000683	68K " "	"	"	—
R189	000683	68K " "	"	"	—
R190	000104	100K " "	"	"	—
R191	000104	100K " "	"	"	—
R192	000104	100K " "	"	"	—
R193	000103	10K " "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R 194	000104	100K 5% 1/4W CARBON	MULLARD	CR25	—
R 195	000104	100K " "	"	"	—
R 196	000104	100K " "	"	"	—
R197	000103	10K " "	"	"	—
R198	000103	10K " "	"	"	—
R199	000103	10K " "	"	"	—
R200	000683	68K " "	"	"	—
R201	000103	10K " "	"	"	—
R202	000104	100K " "	"	"	—
R203	000103	10K " "	"	"	—
R204	000104	100K " "	"	"	—
R205	000103	10K " "	"	"	—
R206	000473	47K " "	"	"	—
R207	000103	10K " "	"	"	—
R208	000104	100K " "	"	"	—
R209	000103	10K " "	"	"	—
R210	000473	47K " "	"	"	—
R211	000104	100K " "	"	"	—
R212	000104	100K " "	"	"	—
R213	000224	220K " "	"	"	1
R214	000103	10K " "	"	"	—
R215	000104	100K " "	"	"	—
R216	000104	100K " "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy
R217	000104	100K 5% 1/4W CARBON	MULLARD	CR25	—
R218	000104	100K " "	"	"	—
R219	000104	100K " "	"	"	—
R220	000104	100K " "	"	"	—
R221	000104	100K " "	"	"	—
R222	000104	100K " "	"	"	—
R223	000102	1K " "	"	"	—
R224	000102	1K " "	"	"	—
R225		NOT USED			
R226	000336	33M 10% 1/4W CARBON	ALLEN BRADLEY	CB	2
R227	000474	470K 5% 1/4W CARBON	MULLARD	CR25	4
R228	000474	470K " "	"	"	—
R229	000474	470K " "	"	"	—
R230	000103	10K " "	"	"	—
R231	000103	10K " "	"	"	—
R232	000156	15M 10% 1/4W CARBON	ALLEN BRADLEY	CB	1
R233	000223	22K 5% 1/4W CARBON	MULLARD	CR25	—
R234	000473	47K " "	"	"	—
R235	000104	100K " "	"	"	—
R236	000104	100K " "	"	"	—
R237	000103	10K " "	"	"	—
R238	000103	10K " "	"	"	—
R239		NOT USED			

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R240	090049	18M 0·2% M/P	HOLCO	H801R	1 PAIR
R241	090049	18M " "	"	"	—
R242	041005	10M 1% 1/2W C/F	ALLEN BRADLEY	CC	1
R243	011003	100K 1% 1/8W M/F	HOLCO	H8	1
R244	013921	3K92 " "	"	"	1
R245	000185	1M8 10% 1/4W CARBON	MULLARD	CR25	1
R246	043924	3M92 1% 1/2W C/F	ALLEN BRADLEY	CC	3
R247	043924	3M92 " "	"	"	—
R248	000474	470K 5% 1/4W CARBON	MULLARD	CR25	—
R249	043924	3M92 1% 1/2W C/F	ALLEN BRADLEY	CC	—
R250	000475	4M7 10% 1/4W CARBON	MULLARD	CR25	1
R251		F.S.V. 1% M/F	HOLCO	H8	1
R252	000336	33M 10% 1/4W CARBON	ALLEN BRADLEY.	CB	—
R253	042215	22M1 1% 1/2W C/F	ALLEN BRADLEY	CC	2
R254	042215	22M1 " "	"	"	—
R255	063104	100K POT CERMET	BECKMAN	72P	—
R256	063205	2M " "	"	"	1
R257		NOT USED			
R258	000223	22K 5% 1/4W CARBON	MULLARD	CR25	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No USED Per Assy.
C1	150001	22µF 16V TANT.	UNION CARBIDE		2
C2	150001	22µF " "	"		—
C3	180006	47µF 25V AL. ELECT	MULLARD	016-16479	2
C4	180006	47µF " "	"	"	—
C5	180021	3µ3F 63V "	"	015-18338	2
C6	180021	3µ3F " "	"	"	—
C7	180022	33µF 40V "	"	016-17339	2
C8	180022	33µF " "	"	"	—
C9	150007	6µ8F 16V TANT	UNION CARBIDE		1
C10	101103	0·01µF CER. DISC	ERIE	801	12
C11	102471	470pF "	"	"	4
C12		NOT USED			
C13		NOT USED			
C14	130003	1000pF 160V POLYSTYRENE	SUFLEX	HS	1
C15	102471	470pF CER. DISC	ERIE	801	—
C16	120002	2µ2F 160V 10% POLYCARB	ADVANCE	MR30A	1
C17 (SEE NOTE 1 BELOW)	140006	0·33µF 10% POLYPROP	WIMA	MKP10	2
C18 "	140006	0·33µF " "	"	"	—
C19		NOT USED			
C20	101103	0·01µF CER. DISC	ERIE	801	—
C21	110002	0·15µF 10% POLYESTER	MULLARD	C280AEP150K	1
C22	102471	470pF CER. DISC	ERIE	801	—
C23	102471	470pF "	"	"	—

NOTES. 1/. USE 140014 IN PLACE OF 140006 UNTIL STOCK IS EXHAUSTED.

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C24		NOT USED			
C25	110004	0·047µF 10% 250V POLYESTER	MULLARD	C280AEP47K	2
C26	102102	1nF CER. DISC	ERIE	801	5
C27	120012	1µF 160V POLYCARB	ADVANCE	CMR20A	1
C28		NOT USED			
C29		NOT USED			
C30	101103	0·01µF CER. DISC	ERIE	801	—
C31	101103	0·01µF "	"	"	—
C32	101103	0·01µF "	"	"	—
C33	101103	0·01µF "	"	"	—
C34	180010	33µF 6V3 AL. ELECT	MULLARD	015-13339	2
C35	180010	33µF " "	"	"	—
C36		NOT USED			
C37	110004	0·047µF 10% POLYESTER	MULLARD	C280 AE P47K	—
C38	101103	0·01µF CER DISC	ERIE	801	—
C39	101103	0·01µF "	"	"	—
C40	101103	0·01µF "	"	"	—
C41	101103	0·01µF "	"	"	—
C42	101103	0·01µF "	"	"	—
C43	101103	0·01µF "	"	"	—
C44	102102	1nF "	"	"	—
C45	102102	1nF "	"	"	—
C46	102102	1nF "	"	"	—

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datron ELECTRONICS LTD

TITLE 1051 D.C. ISOLATOR

DRAWING NUMBER 400087

SHEET 14 OF 25

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C47	102222	2n2F CER DISC	ERIE	801	1
C48	102101	100pF "	"	"	2
C49	102101	100pF "	"	"	—
C50	102102	1nF "	"	"	—

NOTES.

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	63
D2	200001	" "	"	"	—
D3	200001	" "	"	"	—
D4	200001	" "	"	"	—
D5	200001	" "	"	"	—
D6	200001	" "	"	"	—
D7		NOT USED.			
D8	200008	DIODE LOW LEAKAGE	FAIRCHILD	IN458A.	9
D9	200008	" "	"	"	—
D10	200008	" "	"	"	—
D11	200008	" "	"	"	—
D12		NOT USED			
D13		NOT USED			
D14		NOT USED			
D15		NOT USED			
D16	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	—
D17	200001	" "	"	"	—
D18	200001	" "	"	"	—
D19	200001	" "	"	"	—
D20	200008	DIODE LOW LEAKAGE	FAIRCHILD	IN458A	—
D21	200008	" "	"	"	—
D22	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	—
D23	200001	" "	"	"	—

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SHEET 16 OF 25

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No USED Per Assy.
D24	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	–
D25	200001	" "	"	"	–
D26	200008	DIODE LOW LEAKAGE	FAIRCHILD	IN458A	–
D27	200008	" "	"	"	–
D28	200008	" "	"	"	–
D29 – 100		NOT USED			
D101 – 137	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	–
D138		NOT USED			
D139		NOT USED			
D140 – 151	200001	DIODE Si GP	FAIRCHILD / MULLARD	IN4148	–

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
ZD1	210056	ZENER DIODE 5V6 400mW	MULLARD	BZY88 - C5V6	4
ZD2	210056	" "	"	"	—
ZD3	210150	ZENER DIODE 15V 250mW	"	BZY88 - C15	2
ZD4	210150	" "	"	"	—
ZD5	210056	ZENER DIODE 5V6 400mW	"	BZY88 - C5V6	—
ZD6	210056	" "	"	"	—
ZD7	210220	ZENER DIODE 22V 400mW	"	BZY88 - C22	2
ZD8	210220	" "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q1	240001	TRANSISTOR N.P.N GP		BC184/TO18	33
Q2	240001	"		"	–
Q3	240001	"		"	–
Q4	240001	"		"	–
Q5	240001	"		"	–
Q6	240007	TRANSISTOR N.P.N. GP	FAIRCHILD	2N3646	1
Q7	240001	TRANSISTOR N.P.N. GP		BC184/TO18	–
Q8	240001	"		"	–
Q9	240001	"		"	–
Q10	240001	"		"	–
Q11	240001	"		"	–
Q12	240001	"		"	–
Q13	240001	"		"	–
Q14	240001	"		"	–
Q15	240001	"		"	–
Q16	240001	"		"	–
Q17	240001	"		"	–
Q18	240001	"		"	–
Q19	240001	"		"	–
Q20	240001	"		"	–
Q21	240001	"		"	–
Q22	240001	"		"	–
Q23	240001	"		"	–

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q24	240001	TRANSISTOR N.P.N. GP		BC184/TO18	–
Q25	240001	"		"	–
Q26	240001	"		"	–
Q27	240001	"		"	–
Q28	250001	TRANSISTOR P.N.P. GP		BC214/TO18	5
Q29	250001	"		"	–
Q30	250001	"		"	–
Q31	240001	TRANSISTOR N.P.N. GP		BC184/TO18	–
Q32	250001	TRANSISTOR P.N.P. GP		BC214/TO18	–
Q33	240001	TRANSISTOR N.P.N. GP		BC184/TO18	–
Q34	240001	"		"	–
Q35	240001	"		"	–
Q36	240001	"		"	–
Q37	240001	"		"	–
Q38	250001	TRANSISTOR P.N.P. GP		BC214/TO18	–
Q39	240001	TRANSISTOR N.P.N. GP		BC184/TO18	–
Q40	230027	N-CHAN. J FET SELECTED	TELEDYNE	U3114E. ✓	5
Q41	239030	U3114E SELECTED SET. ΔRON<30Ω	"	U3114E	SELECTED SET
Q42	239030	U3114E " " " "	"	U3114E	
Q43	239030	U3114E " " " "	"	U3114E	
Q44	230027	N-CHAN J FET SELECTED	TELEDYNE	U3114E	–
Q45	230027	N- " " "	TELEDYNE	U3114E	–
Q46	230027	N- " " "	TELEDYNE	U3114E	–

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q47	230027	N-CHAN J FET SELECTED	TELEDYNE	U3114E	–
Q48	230003	N-FET SWITCH GP	TELEDYNE / NATIONAL	U1899E / NF510 / K4093-18	2
Q49	230002	N-FET SWITCH GP	"	U1994E / NF500 / K4416-18	3
Q50	230002	"	"	"	–
Q51	230002	"	"	"	–
Q52	240006	TRANSISTOR N.P.N.	FAIRCHILD	2N3904	1
Q53	250004	TRANSISTOR P.N.P.	"	2N3906	1
Q54	240014	TRANSISTOR N.P.N.	"	BC337	1
Q55	250011	TRANSISTOR P.N.P.	"	BC327	1
Q56	230032	N-CHAN J FET	TELEDYNE	U1898E	2
Q57	230032	"	"	"	–
Q58	230003	N-FET SWITCH GP	"	U1899E / NF510 / K4093-18	–
Q59	240017	Si N.P.N. MATCHED PAIR	NATIONAL	LM394	1
Q60	230001	N-CHANNEL CURRENT LIM	SILICONIX	E506	1

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	280001	QUAD 2 I/P MULTIPLEXER	TEXAS/NATIONAL	74C157N	2
M2	280026	4 BIT UP/DOWN DECADE COUNTER	"	74C193	1
M3	280016	QUAD 2 I/P NAND	"	74C00	2
M4	280016	"	"	"	–
M5	280017	HEX INVERTOR	"	14069	1
M6	280019	BCD TO DECIMAL DECODER	"	74C42	1
M7	280018	TRIPLE 3 I/P NAND	"	74C10	1
M8	280001	QUAD 2 I/P MULTIPLEXER	"	74C157N	–
M9	220015	OPTO - ISOLATOR	SPECTRONICS	SPX 33	6
M10	220015	"	"	"	–
M11	220015	"	"	"	–
M12	220015	"	"	"	–
M13	220015	"	"	"	–
M14	220015	"	"	"	–
M15		NOT USED			
M16		NOT USED			
M17		NOT USED			
M18		NOT USED			
M19		NOT USED			
M20		NOT USED			
M21		NOT USED			
M22	260026	LINEAR 212 O.P AMP	NATIONAL	LM212H	3
M23	260026	"	"	LM212H	–

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M24	260002	LINEAR μA741 OP AMP	FAIRCHILD	741 HC	2
M25	260002	"	"	"	–
M26	260032	LINEAR I.C. FET INPUT	RCA	CA3140T	1.
M27	260022	JFET INPUT OP. AMP	NATIONAL	LF 355	1
M28	260026	LINEAR 212 OP. AMP	"	LM 212H	–
RL1	330003	RELAY 28V DP. D.T.	POTTER AND BRUMFIELD	R10-E1-L2-S3.2K	1
	400064	INPUT CABLE ASSEMBLY			1
	410003-11	P.C.B.			1
	450009	UPPER GUARD SHIELD			1
	450010	LOWER GUARD SHIELD			1
	459112	RELAY BRACKET			1

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	510222	7/·2 P.V.C. WIRE RED			A/R
	540001	22 SWG B.T.C. WIRE			A/R
	590001	SLEEVE BLACK	HELLERMAN	H15 x 20mm LG	5
	590004	SLEEVING			A/R
	601002	CONNECTOR SNAP	AMP	60803-1	11
	602001	F.S.V. TERMINAL PIN	MOLEX	02-04-1875	6
J3 - J4	605002	SOCKET D.I.L. 16 PIN	ANTIFERENCE	ICN-163-S3	2
J1 - J2	605005	CONNECTOR 13 WAY	AMP	1-163680-2	2
	605037	SOCKET D.I.L. 14 PIN	ASTRALUX	ICL 163-S6T	4
	605038	SOCKET D.I.L. 16 PIN	"	ICL 143-S3T	4
	605066	SOCKET DIL 6WAY	"	ICY 063 S3T.	6
	611004	SCREW POZIPAN M3x6		M3x6mm	1
	611006	SCREW POZIPAN M3x10		M3x10mm	6
	611007	SCREW POZI CSK M3x6		M3x6mm	6
	612005	STANDOFF M3x23	HARWIN		6
	613005	SHAKEPROOF WASHER M3			7
	615002	NUT M3 HEX		M3	1
	615005	NUT 3-48UNC HEX			1
	613011	NYLON WASHER 6BA			14

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	620001	P.T.F.E. CLOVERLEAF	SEALECTRO	FT-E-12	5
	620002	P.T.F.E. STANDOFF	"	STSM1P51	5
	620003	TERMINAL RIVET	HARWIN	+12106A	10
	630026	MULTI-TURN POT SHROUD	BECKMAN	89B	1
	630036	INSULATING BEAD STEATITE		TYPE Nº 1	4
S1 - S7	700011	SWITCH 7x2 POLE INTERLOCK	LIPA AND ISOSTAT		1
S8 - 10	700013	SWITCH 3x2 POLE PUSH ON/OFF	"		1
S11 - 13	700012	SWITCH 3x2 POLE INTERLOCK	"		1
	700020	BUTTON CHROME	"		13

NOTES.

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R2	000 102	1K 5% ¼W Carbon	Mullard	CR25	5
R3 - R6	050 005	275K .25% ⅛W MF	Erg	EE 0.25 - C-C4	4
R7	000 332	3K3 5% ¼W Carbon	Mullard	CR25	3
R8	050 004	995K .25% ¼W MF	Erg	EE 0.25 - C-C4	3
R9	063 103	10K ⅜" Cer Pot	Beckman	72P	3
R10	050 006	10K1 .25% ⅛W MF	Erg	EE 0.125 - C-C4	2
R11	000 330	33R 5% ¼W Carbon	Mullard	CR25	1
R12	000 222	2K2 5% ¼W Carbon	Mullard	CR25	2
R13	000 825	8M2 10% ¼W Carbon	Mullard	CR25	1
R14	000 105	1M 5% ¼W Carbon	Mullard	CR25	6
R15	050 004	995K .25% ¼W MF	Erg	EE 0.25 - C-C4	-
R16	063 103	10K ⅜" Cer Pot	Beckman	72P	-
R17	050 007	110.5K .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R18	063 102	1K ⅜" Cer Pot	Beckman	72P	2
R19	000 473	47K 5% ¼W Carbon	Mullard	CR25	3
R20	000 332	3K3 5% ¼W Carbon	Mullard	CR25	-
R21	050 004	995K .25% ¼W MF	Erg	EE 0.25 - C-C4	-
R22	063 103	10K ⅜" Cer Pot	Beckman	72P	-
R23	000 473	47K 5% ¼W Carbon	Mullard	CR25	-
R24	000 181	180R 5% ¼W Carbon	Mullard	CR25	1
R25	050 014	99K5 .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R26	063 102	1K ⅜" Cermet Pot	Beckman	72P	-
R27					

NOTES.

PROD / AD. 2.2.77

ISS 15	ISS. 16	ISS 17	ISS. 18	ISS 19 C	ISS. 20	ISS. 21	ISS. 22	ISS 23	ISS 24		
ECO 271	ECO. 357	ECO 392	ECO 415	ECO 423	ECO 542	ECO. 695	669	743	836		
REV 3	REV 4	REV 5	REV. 6	REV. 7	REV. 8	REV. 9	10	11	12	13	14
ECO. 25	ECO. 39	ECO. 43	ECO. 54	ECO. 75	ECO. 123	ECO. 143	160	200	205	220	240

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TITLE 1041 1051 AC CONVERTOR

DRAWING NUMBER 400 037

SHEET 2 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R28	050 006	10K1 .25% $\frac{1}{8}$W MF	Erg	EE .125 - C-C4	-
R29	000 105	1M 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R30	000 104	100K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	10
R31	000 103	10K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	8
R32	000 101	100R 5% $\frac{1}{4}$W Carbon	Mullard	CR25	6
R33	000 820	82R 5% $\frac{1}{4}$W Carbon	Mullard	CR25	2
R34		FSV (68K - 1M)	Welwyn/Mullard	)4033C up to 330K	)1 of Pair
R35		FSV (68K - 1M)	Welwyn/Mullard	)CR25 over 330K	)
R36	063 205	2M $\frac{3}{8}$" Cer Pot	Beckman	72P	4
R37	070 088	2K2 1% Wirewound	Mann	MX125B	2
R38	070 088	2K2 1% Wirewound	Mann	MX125B	-
R39	000 820	82R 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R40	000 272	2K7 5% $\frac{1}{4}$W Carbon	Mullard	CR25	2
R41		FSV (470K - 4M7)	Mullard	CR25	)1 of Pair
R42		FSV (470K - 4M7)	Mullard	CR25	)
R43	000 102	1K0 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R44	000 683	68K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	4
R45	000 154	150K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	2
R46	000 154	150K 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R47	000 682	6K8 5% $\frac{1}{4}$W Carbon	Mullard	CR25	3
R48	000 101	100R 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R49	000 272	2K7 5% $\frac{1}{4}$W Carbon	Mullard	CR25	-
R50	000 221	220R 5% $\frac{1}{4}$W Carbon	Mullard	CR25	1

NOTES.

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1041 AC CONVERTOR
1051

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R51		FSV (220K - 2M2)	Mullard	CR25	1 of Pair
R52		FSV (220K - 2M2)	Mullard	CR25	
R53	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R54	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R55	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R56	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R57					
R58	050 011	3K3 .25% ⅛W MF	Erg	Ee 0.125 - C-C4	2
R59	050 011	3K3 .25% ⅛W MF	Erg	EE 0.125 - C-C4	-
R60	050 010	8K95 .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R61	063 101	100R ⅜" Cer Pot	Beckman	72P	1
R62	050 009	18K .25% ⅛W MF	Erg	EE 0.125 - C-C4	1
R63	050 015	100K .25% ⅛W MF	Erg	EE 0.125 - C-C4	2
R64	000 332	3K3 5% ¼W Carbon	Mullard	CR25	-
R65	050 015	100K .25% ⅛W MF	Erg	EE 0.125 - C-C4	-
R66		FSV (150K - 470K)	Welwyn	4033C	1 of Kit
R67	063 500	50R ⅜" Cer Pot	Beckman	72P	2
R68	000 183	18K 5% ¼W Carbon	Mullard	CR25	2
R69	290 026	Part of RMS Kit	Datron		-
R70	063 500	50R ⅜" Cer Pot	Beckman	72P	-
R71	000 270	27R 5% ¼W Carbon	Mullard	CR25	1
R72	000683	FSV (± 68K) FIT 68K ON ASSY	"	"	-
R73	000 108	1R0 5% ¼W Carbon	Mullard	CR25	1

NOTES.

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TITLE 1041 AC CONVERTOR 1051

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R74	000 912	9K1 5% ¼W Carbon	Mullard	CR25	1
R75	000 152	1K5 5% ¼W Carbon	Mullard	CR25	1
R76	000 473	47K 5% ¼W Carbon	Mullard	CR25	-
R77	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R78	000 682	6K8 5% ¼W Carbon	Mullard	CR25	-
R79	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R80	000 821	820R 5% ¼W Carbon	Mullard	CR25	1
R81	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R82	000 182	1K8 5% ¼W Carbon	Mullard	CR25	2
R83-R84	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R85	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R86	000 183	18K 5% ¼W Carbon	Mullard	CR25	-
R87	000 472	4K7 5% ¼W Carbon	Mullard	CR25	1
R88	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R89	000 474	470K 5% ¼W Carbon	Mullard	CR25	1
R90	000 682	6K8 5% ¼W Carbon	Mullard	GR25	-
R91	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R92	000 102	1K 5% ¼W Carbon	Mullard	CR25	-
R93	000 122	1K2 5% ¼W Carbon	Mullard	CR25	1
R94	000 101	100R 5% ¼W Carbon	Mullard	CR25	-
R95	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R96	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R97	000 182	1K8 5% ¼W Carbon	Mullard	CR25	-

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO 25	ECO 39	ECO 43	ECO 54

SEE SHEET 2 FOR LATEST ISSUE

DATE. 15/08/74

DRAWN BY.

CHECK

NEXT DRAWING

Rev 6 1743

datron ELECTRONICS LTD.

TITLE 1041 1051 AC CONVERTOR

DRAWING NUMBER 400 037

SIGNA	DA N PART No.	DESC TION	PR NPAL MANUFACTURER	NUF URE PART No.	N ED Per Assy.
R98	063 205	2M ⅜" Cer Pot	Beckman	72P	-
R99	000 476	47M 10% ¼W Carbon	Allan Bradley (Morganite)	CB10	1
R100		FSV (4M7 - 10M)	Mullard	CR25	1 of Pair
R101		FSV (4M7 - 10M)	Mullard	CR25	
R102	000 103	10K 5% ¼W Carbon	Mullard	CR25	-
R103	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R104	000 105	1M 5% ¼W Carbon	Mullard	CR25	-
R105	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R106	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R107	000 106	10M 10% ¼W Carbon	Mullard	CR25	6
R108	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R109	063 205	2M ⅜" Cer Pot	Beckman	72P	-
R110	000 106	10M 10% ¼W Carbon	Allan Bradley (Morganite)	CB10	-
R111	050 012	21K .25% ⅛W M/F	ERG	EE 0.125-C-C4	1
R112	050016	5K " " "	"	"	1
R113	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R114	000 222	2K2 5% ¼W Carbon	Mullard	CR25	-
R115	063 205	2M ⅜" Cer Pot	Beckman	72P	-
R116	000 106	10 M 10% ¼W Carbon	Allan Bradley	CB10	-
R117		FSV (1M5 - 10M)	Mullard	CR25	1
R118					
R119	000 104	100K 5% ¼W Carbon	Mullard	CR25	-
R120	000 334	330K 5% ¼W Carbon	Mullard	CR25	1

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6.
ECO. 25	ECO. 39	ECO. 43	ECO. 54

SEE SHEET 2 FOR LATEST ISSUE.

DATE. 15/08/74

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NEXT DRAWING

Rev 27456

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 6 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R121	000 683	68K 5% ¼W Carbon	Mullard	CR25	-
R122	000 105	1M 5% ¼W Carbon	Mullard	CR25	-
R123	000 105	1M 5% ¼W Carbon	Mullard	CR25	-
R124	000 685	6M8 10% ¼W Carbon	Allan Bradley	CB10	1
R125		FSV (0 - 47K) Carbon	Mullard	CR25	
R126	000 106	10M 10% ¼W Carbon	Allan Bradley	CB10	-
R127	000 683	68K 5% ¼W Carbon	Mullard	CR25	-
R128		FSV (1M - 1M8)	Mullard	CR25	
R129	000 226	22 M 10% ¼W Carbon	Allan Bradley	CB10	1
R130		FSV (4R7)			
R131	000106	10M 10% ¼W Carbon	Allan Bradley	CB10	-
R132	000105	1 M 5% ¼W Carbon	Mullard	CR25	-
R133	000106	10M 10% ¼W Carbon	Allan Bradley	CB10	-

NOTES.

REV. 3	REV. 4	REV 5	REV. 6
ECO 25	ECO. 29	ECO 43	ECO 54

SEE SHEET 2 FOR LATEST ISSUE

DATE. 15/08/74

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NEXT DRAWING

Rev 6 23/4/5

datron ELECTRONICS LTD.

TITLE

1041 AC CONVERTOR (01)
1051

DRAWING NUMBER 400 037

SHEET 1 OF 13

SIGNA	DA PART No.	DESC TION	PR PAL MANUFACTURER	NUF URE PART No.	N GED Per Assy.
C1	130 006	82pF 5% 160V PS	Suflex		1
C2	104019	27pF ±1pF 750V	ERIE	N150/BD	1
C3	104020	22pF ±1pF 750V	ERIE	N150/AD	1
C4	170003	100/MF 10% 15v WET TANT		69F245	2
C5	130 025	22pF ±1pF 160V PS	Suflex		3
C6	140 008	10pF PTFE Trimmer	Jackson	VPC Tetfer	3
C7	130 013	18pF ±1pF 160V PS	Suflex		2
C8	120 001	.22mF 10% 1KV Polycarb	Facel		1
C9	130 056	1300pF 2.5% 63V PS	Suflex		1
C10	170003	100/MF 10% 15v WET TANT		69F245	
C11	130 025	22pF ±1pF 160V PS	Suflex		-
C12	130 013	18pF ±1pF 160V PS	Suflex		-
C13	140 008	10pF PTFE Trimmer	Jackson	VPC Tetfer	-
C14	130 024	110pF 2.5% 160V PS	Suflex		1
C15	140 007	15pF PTFE Trimmer	Jackson	VPC Tetfer	2
C16	130 025	22pF ±1pF 160V PS	Suflex		-
C17	130 002	15pF ±1pF 160V PS	Suflex		1
C18	140 008	10pF PTFE Trimmer	Jackson	VPC Tetfer	-
C19	130 040	115 pF 25% 160V PS	Suflex		1
C20	140 007	15pF PTFE Trimmer	Jackson	VPC Tetfer	-
C21	130 012	1200pF 2.5% 63V PS	Suflex		1
C22	150 001	22/MF 16v Tant Bead	Union Carbide	K22E16	6
C23	150 001	22/MF 16v Tant Bead	Union Carbide	K22E16	-

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO. 25	ECO. 39	ECO. 43	ECO. 54

SEE SHEET 2 FOR LATEST ISSUE

DATE. 15/08/74

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NEXT DRAWING Rev 6 22/4/5

datron ELECTRONICS LTD.

TITLE 1041 1051 AC CONVERTOR

DRAWING NUMBER 400 037

SHEET 8 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C24					
C25	102228	2·2pF 500V Cer Disc	Erie		1
C26					
C27	102 221	220pF 500V Cer Disc	Erie	831	1
C28	102 471	470pF 500V Cer Disc	Erie	801	4
C29	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	4
C30		NOT USED			
C31	102 102	1000pF 500V Cer Disc	Erie	801	4
C32	102 101	100pF 500V Cer Disc	Erie	801	3
C33	102 102	1000pF 500V Cer Disc	Erie	801	-
C34	102 471	470 pF 500V Cer Disc	Erie	801	-
C35	102 471	470 pF 500V Cer Disc	Erie	801	-
C36	102 102	1000pF 500V Cer Disc	Erie	801	-
C37	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	-
C38	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	-
C39					
C40	101 103	.01mF 250V Cer Disc	Erie	801	1
C41	120 010	1.5mF 10% 160V PC	Advance Filmcap	CMR25A	1
C42	120 024	6.8mF 10% 63V PY	Advance Filmcap	MD45A	1
C43	110 009	1·0 mF 20% 100V PC	WIMA	MKS	1
C44	110 010	·22 mF 20% 250V PY	MULLARD	C280	1
C45	102 101	100pF 500V Cer Disc	Erie	801	-
C46	102 101	100pF 500V Cer Disc	Erie	801	-

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO. 25	ECO. 39	ECO 43	ECO. 54

SEE SHEET 2 FOR LATEST ISSUE

DATE. 15/08/74

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NEXT DRAWING

Rev 6 2345

datron ELECTRONICS LTD.

TITLE

1041 AC CONVERTOR
1051

DRAWING NUMBER 400 037

SHEET 9 OF 13

SIGNA	DA N PART No.	DES TIO	PR IPAL MANUFACTURER	ANUF URE PART No.	USED Per Assy.
C47	102 220	22pF 500V Cer Disc	Erie	831	1
C48	102 470	47 pF 500V Cer Disc	"	"	1
C49	150 010	.33mF 35V Tant Bead	Union Carbide	KR33E35	1
C50	150 005	2.2mF 16V Tant Bead	Union Carbide	K2R2E16	1
C51	150 002	10mF 16V Tant Bead	Union Carbide	K10E16	-
C52	150 001	22mF 16V Tant Bead	Union Carbide	K22E16	-
C53	150 001	22mF 16V Tant Bead	Union Carbide	K22E16	-
C54	102 471	470pF 500V Cer Disc	Erie	801	-
C55-C56- C59	*	Twisted Wire Pair			*
C57-C58	150 001	22mF/16V Tant Bead	Union Carbide	K22E16	-
C60	102 102	1000pf 500R Cer Disc	ERIE	801	-
D1	Not Used				
D2-6, D8+9, D12+13	200 001	Diode Sil GP Switch		IN4148	18
D7, D14, D15	210 056	Diode Zener 5.6V		BZY88C5V6	4
D16	210 100	Diode Zener 10V		BZY88C10V	1
D17	200 001	Diode Sil GP Switch.		IN4148	
D18- D21	200 001	Diode Sil GP Switch		IN4148	-
D22- D24	220 010	Diode Sil Hot Carrier	HP	HSCH1001 / IN6263	3
D25- D28	200 001	Diode Sil GP Switch		IN4148	-
D29- D32, D10, D11	200 008	Diode Sil Low Leak		IN458A	6
D33	210 056	Diode Zener 5.6V		BZY88C5V6	-

NOTES.

* Use very stiff insulated wire about ½" long - guage approx. .8mm.
May use bare wire with insulating sleeving.

REV. 3	REV. 4	REV 5	REV. 6
ECO. 25	ECO. 39	ECO. 43	ECO. 54

SEE SHEET 2 FOR LATEST ISSUE

DATE. 15/08/74
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CHECK
NEXT DRAWING
Rev 6 2345

datron ELECTRONICS LTD.

TITLE
1041 AC CONVERTOR
1051

DRAWING NUMBER 400 037

SHEET 10 OF 13

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q1	240 001	Sil N.P.N. Hi HFE GP		BC184K	4
Q2	230 003	N Fet GP Switch	Teledyne	U1899E/K4093-18	5
Q3	230 003	N Fet GP Switch		U1899E/K4093-18	-
Q4	230 003	N Fet GP Switch		U1899E/K4093-18	-
Q5	230 003	N Fet GP Switch		U1899E/K4093-18	-
Q6a, Q6b	230 009	Sil Monolithic Dual Fet		2N3956	1
Q7	240 013	Sil N.P.N. Hi HFE GP		BC184KC	1
Q8	240 011	Sil N.P.N. GP		BC338	1
Q9	230 003	N Fet GP Switch	Teledyne	U1899E/K4093-18	-
Q10	250 004	Sil P.N.P. HF GP		2N3906	6
Q11	240 001	Sil N.P.N. GP		BC184K	-
Q12	250 004	Sil P.N.P. HF GP		2N3906	-
Q13	250 004	Sil P.N.P. HF GP		2N3906	-
Q14	240 006	Sil N.P.N. HG GP		2N3904	2
Q15	240 001	Sil N.P.N. Hi HFE GP		BC184K	-
Q16	230 002	N Fet GP	Teledyne	U1994E/K4416-18	2
Q17	250 004	Sil P.N.P. HF GP		2N3906	-
Q18	250 004	Sil P.N.P. HF GP		2N3906	-
Q19	240 006	Sil N.P.N. HF GP		2N3904	-
Q20	250 004	Sil P.N.P. HF GP		2N3906	-
Q21	230 002	N Fet GP	Teledyne	U1994E/K4416-18	-
Q22	240 001	Sil N.P.N. Hi HFE GP		BC184K	-
Q23, Q24, Q25	230022	N Fet Switch		E106/2N5434	3

NOTES.

REV. 3	REV. 4	REV. 5	REV. 6
ECO 25	ECO. 39	ECO 43	ECO 54

SEE SHEET 2 FOR LATEST ISSUE

DATE. 15/08/74

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NEXT DRAWING

Rev 6 2743

datron ELECTRONICS LTD.

TITLE 1041 AC CONVERTOR 1051

DRAWING NUMBER 400 037

SHEET 11 OF 13

SIGNA	DA N PART No.	DESC TION	PR PAL MANUFACTURER	NUF URE PART No.	SED Per Assy.
M1	260 009	Wide Band Op Amp	National	LM318H	1
M2	260025	Precision GP Op Amp	National	LM101	4
M3	260025	Precision GP Op Amp	National	"	-
M4	260025	Precision GP Op Amp	National	"	-
M5	260025	Precision GP Op Amp	National	"	-
M6	290 026	RMS Module Kit	Datron		1
	510999	WIRE 7/0-2 WHITE			A/R
K1 , K2	330003	Relay	A.M.F.	R10-E1-L2-Q5·8K	2
	459112	RELAY BRACKET			2
	410 006 - 8A	Printed Circuit Board			1
	400084	AC. INPUT LEAD ASSY.			1
	604 004	Pin Plugs	Amp	1 - 163749 - 2 (1)	1
	450 012	GUARD SHIELD			1
	612 005	Stand-Off Rivet M3	Harwin		4
	620 001	Cloverleaft Bush	Sealectro		8
	620 003	Rivet Solder Terminal	Harwin	H2105A	7
	602 001	FSV Terminals	Molex	02 - 04 - 1875	26
	630 003	P Clip ¼"			1
	611 016	M3 x 8 Pozipan	GKN		7
	590 011	BLACK SLEEVE	HELLARMAN	H15	A/R
	615 002	M3 Hex Nut			3
	613 005	M3 Shkprf Washer			7

NOTES.

(1) Strip of 13 pins

DATE.	datron ELECTRONICS LTD.
15/08/74	
DRAWN BY.	TITLE
CHECK	1041 AC CONVERTOR 1051
NEXT DRAWING	DRAWING NUMBER 400 037
Rev 6	SHEET 12 OF 13

REV. 3	REV. 4	REV. 5	REV. 6
ECO. 25	ECO. 38	ECO. 43	ECO. 54

SEE SHEET 2 FOR LATEST ISSUE

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	540002	22 SWG TINNED CU WIRE			A/R
	590004	SILICON RUBBER SLEEVE			A/R
	602004	BREAKAWAY TERMINAL STRIP.	MOLEX	1938-4.	NO.
	590001	HELLERMAN SLEEVES BLACK.	HELLERMAN	H15 x 20MM LG	3.
	630018	GROMMET			1.

NOTES.

DATE 7.4.77	datron ELECTRONICS LTD
DRAWN BY P.J.H	TITLE AC OPTION 01
CHECK	
NEXT DRAWING	DRAWING NUMBER 400037 SHEET 13 OF 13

ISS. SEE SHT 2

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
(R1, R2) & (R3, R4)	090012	9K1/9K1 0·02% MATCHED PAIR.	MANN	3C-BT	2
R5.	070046	9K1 0·02%	"	3C-C	1
R6.	070060	500R 0·02%	"	3C-SPECIAL	1
R8.	070033	4K53 0·02%	"	3C-C	1
R9.	070040	44K975 0·02%	MANN	3C-C	1
R10.	070043	449K75 0·02%	"	3D-C	1
R11.	045623	562K 1% ¼W MF	HOLCO	HB	1
R12-R13	011002	10K 1% ¼W MF	WELWYN	4033C	2
R14.	090 003	MATCHED PAIR MF 2M2	ERG.		1 SET.
R15.		2K2/2M2 0·2% 2K2			
R16-R17.	440026	FSV (150K-3M3)			1 OF KIT.
R18-R19.	440027	FSV (560K-4M7)			1 OF KIT.
R20.	014758	47R5 1% ¼W MF	WELWYN	4033C	1
R21.	000224	220K 5% ¼W CARBON	MULLARD	CR25	1
R22.	005681	680R 5% ½W MET-OX	ELECTROSIL	TR5	1
R23.	000824	820K 5% ¼W CARBON	MULLARD	CR25	1
R24.	000476	47M 10% ¼W CARBON	ALLEN BRADLEY	CB10	1
R25.	000473	47K 5% ¼W CARBON	MULLARD	CR25	3
R26-R32.	000104	100K 5% ¼W CARBON	MULLARD	CR25	7
R33-R39.	000106	10M 10% ¼W CARBON	MULLARD	CR25	8
R40-R41.	000473	47K 5% ¼W CARBON	MULLARD	CR25	–
R42.	000106	10M 10% ¼W CARBON	MULLARD	CR25	–
R43	000562	5K6 5% ¼W CARBON	MULLARD	CR25	1

NOTES.

SEE SHEET 2 FOR LATEST ISSUE

ISS	10	11	12	13	14 C	15	16	17	18			
ECO	206	274	425	520	602	658	696	750/753	844			
DATE	–	–	–	–	14-3-78	15.3.78	30.5.78	28-Nov-78	6-4-79			
CHKD	–	–	–	–	MD	MD	MD	MD	MD			

DATE	29-12-77
REDRAWN	B.J.
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APPROVED	
DATE	

datron ELECTRONICS LTD

TITLE: 1051 RESISTANCE CONVERTER (0.3.)

DRAWING NUMBER: 400089

SHEET 2 OF 5

J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R44.	000474	470K 5% ¼W CARBON	MULLARD	CR25	1
R45.	000103	10K 5% ¼W CARBON	MULLARD	CR25	1
R46.	000225	2M2 10% ¼W CARBON	MULLARD	CR25	1
R47-R48.	090001	PTC THERMISTOR	MULLARD	VA 8650	2
R49-R50.	063100	10R 3/8" CERMET POT	BECKMAN	72P	3.
R51.	063100	10R 3/8" CERMET POT	BECKMAN	72P	—
R52.	063204	200K 3/8" CERMET POT	BECKMAN	72P	2
R53.	063500	50R 3/8" CERMET POT	BECKMAN	72P	1
R54.	063501	500R 3/8" CERMET POT	BECKMAN	72P	1
R55.	063205	2M 3/8" CERMET POT	BECKMAN	72P	1
R56.	000105	1M 5% ¼W CARBON	MULLARD	CR25	1
R57 & R58.	000222	2K2 5% ¼W CARBON	MULLARD	CR25	2
R59.	063204	200K 3/8" CERMET POT	BECKMAN	72P	—
R60.	000123	12K 5% ¼W CARBON	MULLARD	CR25	1
C1 & C5	102102	1KpF 500V CER DISC	ERIE	801	2
C2 & C3.	102471	470pF 500V CER DISC	ERIE	801	2
C4.	102221	220pF 500V CER DISC	ERIE	801	1
C6	102330	33pF 500V CER DISC	ERIE	801	1
D1-D7 & D27	200008	LOW LEAKAGE DIODE	FAIRCHILD	IN458A	10
D8-D26 & D28	200001	GP SIL. DIODE	FAIRCHILD	IN4148	20
D31.	213001	10v 5w ZENER		IN5347	3
D32 - D34	200006	SIL RECT HI VOLT		IN4005	3
D35 & D40	200008	LOW LEAKAGE DIODE	FAIRCHILD	IN458A	—

NOTES.

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ISS.													
E.C.O													
DATE													
CHKD													

DATE 29-12-77

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DATE

datron ELECTRONICS LTD

TITLE 1051 RESISTANCE CONVERTER (0.3.)

DRAWING NUMBER 400089

SHEET 3 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D36 & D37	213001	10V 5W ZENER		IN5347	–
D39	210033	3V3 400MW ZENER		BZY88C 3V3	1
Q1	250001	TRANSISTOR SIL. P.N.P. GP	WAYCOM	BC214K	1
Q2	230032	N FET SIL GP SWITCH.	TELEDYNE	U1898E	1
Q3 – Q8	230002	N FET SIL GP	TELEDYNE	U1994E / K4416-18.	6
Q9	240012	TRANSISTOR SIL N.P.N. 1 WATT	MOTOROLA	2N3053	1
Q10	250006	TRANSISTOR SIL P.N.P. GP	FAIRCHILD	BC322	1
	450011	GUARD SHIELD			1
M1	260025	LINEAR I.C. 101		LM101	1
M2	260026	LINEAR I.C. LM212H	NATIONAL	LM212H	1
M3.	260026	LINEAR I.C. LM212H	NATIONAL	LM212H	1
RL1	330001	RELAY BIF 4P2W 28V.	POTTER & BRUMFIELD	R10-E1-L4-Q2-5K	1
	540001	B.T.C WIRE 24SWG			A/R
	459112	RELAY BRACKET	KDP ES	459112	1
	590001	SLEEVE BLACK.	HELLERMAN	H15 x 20 MM. LG	20
J1	604004	13 WAY AMP MALE CNCTR	AMP	1-163749-2	1 SET
	410007 – 5A	PCB			
	602001	FSV TERMINAL	MOLEX	02-04-1875	8
	612005	23MM x M3 RIVET SNDF	HARWIN	CS	3
	620003	RIVET SOLDER TERMINAL	HARWIN	HZ105A	8
	630003	P-CLIP	PLEX.1		2
	611004	M3 x 6MM POZIPAN	GKN		6
	615002	M3 NUT	GKN		3

NOTES.

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ISS.													
E.C.O.													
DATE													
CHKD													

DATE 29-12-77	datron ELECTRONICS LTD
DRAWN	TITLE 1051 RESISTANCE CONVERTER (03)
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APPROVED	
DATE	DRAWING NUMBER 400089 SHEET 4 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	613005	M3 SHAKEPROOF WASHER	GKN		6
	590011	BLACK SLEEVE REEL	HELLARMAN	HIS	A/R
	400065/A	INPUT CABLE ASSY			1
	400065/B	INPUT CABLE ASSY			1

NOTES.

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ECO												
DATE												
CHKD												

DATE 29-12-77

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TITLE 1051 RESISTANCE CONVERTER (03)

DRAWING NUMBER 400089

SHEET 5 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000 102	1K 5% ¼W CARBON	MULLARD	CR25	10
R2	000 272	2K7 "	"	"	3
R3	063 203	20K PoT CERMET	BECKMAN	72P	1
R4	000 221	220R 5% ¼W CARBON	MULLARD	CR25	3
R5	000 221	220R "	"	"	—
R6	090 013	36K07 .02% MATCHED	MANN	3C-BT	1
R7		9K1 .02% PAIR			—
R8	000 103	10K 5% ¼W CARBON	MULLARD	CR25	17
R9	000 102	1K "	"	"	—
R10	000 103	10K "	"	"	—
R11	000 103	10K "	"	"	—
R12	000 103	10K "	"	"	—
R13	000 103	10K "	"	"	—
R14	000 103	10K "	"	"	—
R15	000 103	10K "	"	"	—
R16	000 103	10K "	"	"	—
R17	000 103	10K "	"	"	—
R18	041 004	1M 1% ½W MF	WELWYN	4033C	1
R19	000 185	1M8 5% ¼W CARBON	MULLARD	CR25	1
R20	000 105	1M "	"	"	8
R21	000 105	1M "	"	"	-
R22	000 105	1M "	"	"	-
R23	000 105	1M "	"	"	—

NOTES.

ISS 38 745 756 24/1/78	39. 780 781								
ISS.29 ECO 537	30 ECO 558	31 ECO 573	32 ECO 595	33. ECO 610	34 ECO 649	35. ECO 684	36. ECO 682	37. 720/732.	
ISS. 2 ECO 58	3 ECO 63	4 ECO 62	5 ECO 70	6 ECO 76	7 ECO 72	8 ECO 93	9 ECO 111	10 ECO 130	
11 ECO 137	12 ECO 141	13 ECO 146	14 ECO 157	15 ECO 173	16 ECO 202	17 ECO 212	18 ECO 217	19 ECO 228	
20 ECO 286	21 ECO 244	22 ECO 364	23 ECO 446	24 ECO 451	25 ECO 382	26 ECO 467	27 ECO 509	28 ECO 540	

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000 153	15K 5% 1/4W CARBON	MULLARD	CR 25	2
R25	000 102	1K "	"	"	—
R26	000 104	100K "	"	"	17
R27	000 104	100K "	"	"	—
R28	000 104	100K "	"	"	—
R29	000 104	100K "	"	"	—
R30	000 104	100K "	"	"	—
R31	000 562	5K6 "	"	"	3
R32	000 106	10M 10% 1/4W CARBON	"	"	3
R33	000 225	2M2 "	"	"	1
R34	000 106	10M "	"	"	—
R35	000 106	10M "	"	"	—
R36		NOT USED			
R37		FSV			
R38		FSV			
R39	014021	4k02 1% 1/8W MF	WELWYN		1
R40	000 912	9k1 5% 1/4W CARBON	MULLARD	CR25	1
R41	000 682	6K8 "	"	"	4
R42	000 472	4K7 "	"	"	4
R43	000 156	15M 10% 1/4W CARBON	ALLEN BRADLEY	CB 1561	1
R44	NOT USED				
R45	000 226	22M 10% 1/4W CARBON	ALLEN BRADLEY	CB 10	1
R46	063 101	100R POT CERMET	BECKMAN	72P	1

NOTES.

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SHEET 3 OF 23

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R47	000 221	220 5% ¼W CARBON	MULLARD	CR25	—
R48		FSV 5% ¼W CARBON	"	"	1
R49		FSV 5% ¼W CARBON	"	"	1
R50	000 102	1K "	"	"	—
R51	000 472	4K7 "	"	"	—
R52	000 222	2K2 "	"	"	1
R53	000 224	220K "	"	"	2
R54	000 103	10K "	"	"	—
R55	000 103	10K "	"	"	—
R56	NOT USED				
R57	000 472	4K7 5% ¼W CARBON	MULLARD	CR25	—
R58	000 101	100R "	"	"	9
R59	000 101	100R "	"	"	—
R60	000 101	100R "	"	"	—
R61	000 473	47K "	"	"	7
R62	000 184	180K "	"	"	1
R63	011 002	10K 1% ⅛W MF	WELWYN	4033C	1
R64	013 922	39K2 "	"	"	1
R65	017 870	787R "	"	"	1
R66	090 029	9k1 ·1% MATCHED	MANN	3C-BT	1
R67		6k55 ·1% PAIR			
R68	090 013	9K1 .02% MATCHED	"	3C-BT	1
R69		9K1 .02% PAIR			

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R70		FSV 1% 1/8W MF	WELWYN	4033C	1
R71		FSV			
R72	000 272	2K7 5% 1/4W CARBON	MULLARD	CR 25	—
R73	000 155	1M5 10% 1/4W CARBON	"	"	1
R74	000 682	6K8 5% 1/4W CARBON	"	"	—
R75	000 682	6K8 "	"	"	—
R76	063 100	10R POT CERMET	BECKMAN	72P	2
R77	000 101	100R 5% 1/4W CARBON	MULLARD	CR25	—
R78	063 100	10R POT CERMET	BECKMAN	72P	—
R79	063 205	2M " "	"	"	2
R80	063 504	500K " "	"	"	2
R81	063 504	500K " "	"	"	—
R82	063 205	2M " "	"	"	—
R83	000 563	56K 5% 1/4W CARBON	MULLARD	CR25	2
R84	000 104	100K "	"	"	—
R85	000 102	1K "	"	"	—
R86	000 105	1M "	"	"	—
R87	000 105	1M "	"	"	—
R88	000 107	100M 10% 1/4W CARBON	ALLEN BRADLEY	CB 1071	2
R89		FSV 10% 1/4W CARBON (1M)	MULLARD	CR25	1
R90	000 101	100R 5% 1/4W CARBON	"	"	—
R91	000 101	100R "	"	"	—
R92	000 101	100R "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R93	000 182	1K8 5% ¼W CARBON	MULLARD	CR 25	2
R94		FSV 10% ¼W CARBON (ISM)			1
R95	000 223	22K 5% ¼W CARBON	MULLARD	CR25	6
R96	000 107	100M 10% ¼W. CARBON	ALLEN BRADLEY	CB 1071	—
R97	NOT USED				
R98	"				
R99	"				
R100	000 101	100R 5% ¼W CARBON	MULLARD	CR25	—
R101	000 104	100k 5% ¼W CARBON	"	CR25	—
R102	000 125	1M2 5% ¼W CARBON	"	CR25	1
R103	000 151	150R "	"	"	1
R104	000 562	5k6 "	"	"	—
R105	000 562	5k6 "	"	"	—
R106	000 331	330R "	"	"	1
R107	000 390	39R "	"	"	1
R108	000 105	1M "	"	"	—
R109	000 102	1K "	"	"	—
R110	000 103	10K "	"	"	—
R111	000 102	1K "	"	"	—
R112	063 102	1K POT CERMET	BECKMAN	72P	1
R113	015 231	5K23 1% ⅛W MF	WELWYN	4033C	2
R114	015 231	5K23 1% ⅛W MF	WELWYN	4033C	—
R115	000 823	82K 5% ¼W CARBON	MULLARD	CR25	3

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R116	000 823	82K 5% ¼W CARBON	MULLARD	CR25	—
R117	000 102	1K "	"	"	—
R118	000 686	68M 10% ¼W CARBON	"	"	1
R119	NOT USED				
R120	000 104	100K 5% ¼W CARBON	MULLARD	CR25	—
R121	000 153	15K "	"	"	—
R122	000 224	220K "	"	"	—
R123	000 473	47K "	"	"	—
R124	000 223	22K "	"	"	—
R125	000 180	18R "	"	"	1
R126	000 103	10K "	"	"	—
R127	000 104	100K "	"	"	—
R128	000 332	3K3 "	"	"	2
R129	000 104	100K "	"	"	—
R130	000 104	100K "	"	"	—
R131	000 104	100K "	"	"	—
R132	000 473	47K "	"	"	—
R133	000 563	56K "	"	"	—
R134	000 104	100K "	"	"	—
R135	000 823	82K "	"	"	—
R136	000 103	10K "	"	"	—
R137	000 103	10K "	"	"	—
R138	000 223	22K "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R139	000 123	12K 5% ¼W CARBON	MULLARD	CR25	1
R140	000 104	100K "	"	"	—
R141	000 223	22K "	"	"	—
R142	000 223	22K "	"	"	—
R143	000 104	100K "	"	"	—
R144	000 104	100K "	"	"	—
R145	000 333	33K "	"	"	2
R146	000 393	39K "	"	"	1
R147	000 333	33K "	"	"	—
R148	000 104	100K "	"	"	—
R149	000 182	1K8 "	"	"	—
R150	000 103	10K "	"	"	—
R151	000 683	68K "	"	"	1
R152	000 472	4K7 "	"	"	—
R153	000 682	6K8 "	"	"	—
R154	000 332	3K3 "	"	"	—
R155	000 223	22K "	"	"	—
R156	000 272	2K7 "	"	"	—
R157	000 473	47K "	"	"	—
R158	000 102	1K "	"	"	—
R159	000 102	1K "	"	"	—
R160	000 473	47K "	"	"	—
R161	000 473	47K "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R162	000 473	47K 5% ¼W CARBON	MULLARD	CR25	—
R163	000 103	10K "	"	"	—
R164	000 105	1M "	"	"	—
R165	000 101	100R 5% " "	"	"	—
T1	310 002	PULSE Tx	NEWPORT INST.	76616/4HV	3
T2	310 002	"	"	"	—
T3	310 002	"	"	"	—
T4	300 007	TOROIDAL MAINS Tx			1
T5	300 006	STEP-UP Tx	NEWPORT INST.	B79399	1

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
L1	370 001	RF CHOKE 10μH	PLESSEY	58/10/0011/10	1
W1	209 003	BRIDGE RECTIFIER 100V 1.5A	GI	WS01	1
W2	209 004	" 100V 1A	"	W01	2
W3	209 004	" 100V 1A	"	W01	—
W4	209 007	" 400V 1A	"	W04	1
C1	180 020	1000μF 25V Al ELECT	WIMA	PRINTILYT 3	5
C2	180 020	1000μF "	"	"	—
C3	150 001	22μF 16V TANT	UNION CARBIDE	K22E16	12
C4	150 001	22μF "	"	"	—
C5	150 001	22μF "	"	"	—
C6	150 001	22μF "	"	"	—
C7	150 001	22μF "	"	"	—
C8	150 001	22μF "	"	"	—
C9	150 001	22μF "	"	"	—
C10	101 103	.01μF 250V CER DISC	ERIE	801	11
C11	101 103	.01μF "	"	"	—
C12	101 103	.01μF "	"	"	—
C13	101 103	.01μF "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C14	101 103	.01μF 250v Cer Disc	ERIE	801	—
C15	150 008	.47μF 35v Tant	UNION CARBIDE	KR47E35	1
C16	101 103	.01μF 250v Cer Disc	ERIE	801	—
C17	110 017	22nF 250v Polyester	MULLARD	C280AE/P22K	1
C18	101 103	.01μF 250v Cer Disc	ERIE	801	—
C19	102 102	1nF 500v Cer Disc	"	"	7
C20	102 100	10pF 500v Cer Disc	"	"	3
C21	102 330	33pF 500v Cer Disc	"	"	3
C22	102 330	33pF "	"	"	—
C23	102 330	33pF "	"	"	—
C24	102 100	10pF 500v Cer Disc	"	"	—
C25	102 102	1nF 500v Cer Disc	"	"	—
C26	110 013	0.1MF 250v Polyester	MULLARD	C280AE/P100K 20%	3
C27	150 001	22μF 16v Tant	Union Carbide	K22E16	—
C28	140 019	150pF 1%. 400v Silvered Mica	I.T.T.	454/52-150pF	1
C29	110 002	.15μF 250v Polyester	MULLARD	C280AE/P150K	1
C30	140 002	.47μF 10% Polyprop.	WIMA	MKP10	1
C31	102 102	1nF 500v Cer Disc	ERIE	801	—
C32	110 008	.68μF 100v	WIMA	MKS	1
C33	102 101	100pF 500v Cer Disc	ERIE	801	3
C34	102 101	100pF "	"	"	—
C35	102 101	100pF "	"	"	—
C36	NOT USED				

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C37	150 001	22µF 16V TANT	UNION CARBIDE	K22E16	—
C38	102102	1nF 500V CER DISC	ERIE	801	—
C100	180 020	1000µF 25V Al ELECT.	WIMA	PRINTILYT 3	—
C101	180 020	1000µF "	"	"	—
C102	101 103	.01µF 250V CER DISC	ERIE	801	—
C103	150 018	220µF 6V3 TANT	UNION CARBIDE	K220E6V3	1
C104	110 026	6800pF 100V POLYESTER	WIMA	FKS2	2
C105	110 026	6800pF "	"	"	—
C106	150 001	22µF 16V TANT	UNION CARBIDE	K22E16	—
C107	180 020	1000µF 25V Al. ELECT	WIMA	PRINTILYT 3	—
C108	180 019	10µF 250V Al. ELECT	ERIE	21101-100	1
C109	140020	220pF 1% 400V SILVERED MICA	I.T.T.	45A-52-220pf	2
C110	140020	220pF "	"	"	—
C111	150 001	22µF 16V TANT	UNION CARBIDE	K22E16	—
C112	120 014	2.2µF 63V P.E.T.P FILM	ADVANCE	MD30A	1
C113	150 001	22µF 16V 20% TANT	UNION CARBIDE	K22E16	—
C114	102 102	1nF 500V CER DISC	ERIE	801	—
C115	110 005	.01µF 250V POLYESTER	MULLARD	C280AE/P10K	4
C116	110 005	.01µF "	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
C117	150 010	.33µF 35V TANT.	UNION CARBIDE	KR33E35	1
C118	150 007	6.8µF 16V TANT	"	K6R8E16	1
C119	101 103	.01µF 250V CER DISC	ERIE	801	—
C120	101 103	.01µF "	"	"	—
C121	150 012	0.1µF 35V TANT	UNION CARBIDE	KR1E35	1
C122	102 221	220pF 500V CER DISC	ERIE	801	1
C123	110 005	0.01µF 250V POLYESTER	MULLARD	C280AE/P10K	—
C124	101 103	.01µF 250V CER DISC	ERIE	801	—
C125	102 102	1nF 500V CER DISC	"	"	—
C126	102 471	470pF 500V CER DISC	"	"	1
C127	110 005	0.01µF 250V POLYESTER	MULLARD	C280AE/P10K	—
C128	102 100	10pF 500V CER DISC	ERIE	801	—
C129	102 102	1nF "	"	801	—
C130	150 005	2.2µF 16V TANT	UNION CARBIDE	K2R2E16	2
C131	150 002	10µF 16V TANT	"	K10E16	1
C132	150 003	47µF 6V3 TANT	"	K47E6	1
C133	110 013	.1µF 250V POLYESTER	MULLARD	C280AE/P100K	—
C134	150 005	2.2µF 16V TANT	UNION CARBIDE	K2R2E16	—
C135	110 013	.1µF 250V POLYESTER	MULLARD	C280AE/P100K	—
C136	150 009	3.3µF 16V TANT	UNION CARBIDE.	K3R3E16	1

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200 008	LOW LEAKAGE	FAIRCHILD	1N458A	10
D2	200 008	"	"	"	—
D3	NOT USED				
D4	210 100	ZENER 10V 400mW	MULLARD	BZY88-C10	3
D5	NOT USED				
D6	200 008	LOW LEAKAGE	FAIRCHILD	1N458A	—
D7	200 008	"	"	"	—
D8	200 008	"	"	"	—
D9	200 008	"	"	"	—
D10	200 008	"	"	"	—
D11	200 001	Si, GP		1N4148	27
D12	200 001	"		"	—
D13	200 001	"		"	—
D14	200 008	LOW LEAKAGE	FAIRCHILD	1N458A	—
D15	200 001	Si, GP		1N4148	—
D16	200 001	"		"	—
D17	200 001	"		"	—
D18	200 008	LOW LEAKAGE	FAIRCHILD	1N458A	—
D19	200 008	"	"	"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D20	210 100	ZENER 10v 400mW	MULLARD	BZY88-C10	—
D21		NOT USED			
D22	210 056	" 5V6 "	"	BZY88-C5V6	1
D23	210 075	" 7V5 "	"	BZY88-C7V5	2
D24	210 075	" 7V5 "	"	BZY88-C7V5	—
D25	210 240	" 24V "	"	BZY88-C24	1
D26	200 001	Si, GP	"	IN4148	—
D27	200 001	Si, GP		IN4148	—
D28	NOT USED				
D29	NOT USED				
D30	210 043	ZENER 4v3 400mW	MULLARD	BZY88-C4v3	1
D31	200 001	Si, GP		IN4148	—
D32	200 001	"		"	—
D33	210 082	ZENER 8V2 400mW	MULLARD	BZY88-C8V2	1
D34	200 001	Si, GP		IN4148	—
D35	200 001	"		"	—
D36	210 100	ZENER 10v 400mW	MULLARD	BZY88-C10	—
D37	200 001	Si, GP		IN4148	—
D38	200 005	Ge, GP	HUGHES	HG 5009	2
D39	200 005	"	"	"	—
D40	200 001	Si, GP		IN4148	—
D41	200 001	"		"	—
D42	200 001	"		"	—

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DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D43	200 001	Si, GP		IN4148	—
D44	200 001	"		"	—
D45	200 001	"		"	—
D46	200 001	"		"	—
D47	200 001	"		"	—
D48	200 001	"		"	—
D49	200 001	"		"	—
D50	210 150	ZENER 15v 400mW	MULLARD	BZY88-C15	1
D51	200 001	Si, GP		IN4148	—
D52	200 001	"		"	—
D53	200 001	"		"	—
D54	200 001	"		"	—

NOTES.

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TITLE: 1051 A-D

DRAWING NUMBER: 400094

SHEET 16 OF 22

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J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M1	280 008	QUAD NAND	MOTOROLA	MC14011CP	10
M2	270 024	7 SEG. DECODER/DRIVER	SPERRY	DD700	1
M3	280 001	4 POLE 2WAY MULTIPLEXER	NATIONAL	MM74C157N	1
M4	290 016	DIGITAL VOLTMETER LOGIC ARRAY	FAIRCHILD	3814DC	1
M5	280 009	HEX BUFFER	MOTOROLA	MC14049CP	5
M6	280 003	QUAD LATCH	"	MC14042CP	1
M7	280 012	DECADE COUNTER	NATIONAL	MM74C163N	1
M8	280 007	TRIPLE NAND	MOTOROLA	MC 14023CP	3
M9	280 010	DECADE COUNTER	NATIONAL	MM74C160N	1
M10	280 008	QUAD NAND	MOTOROLA	MC 14011CP	—
M11	280 009	HEX BUFFER	"	MC 14049CP	—
M12	280008	QUAD NAND	"	MC 14011CP	—
M13	280 011	DUAL D FLIP-FLOP	"	MC 14013CP	3
M14	280008	QUAD NAND	"	MC 14011CP	—
M15	280 008	"	"	"	—
M16	280 011	DUAL D FLIP-FLOP	"	MC 14013CP	—
M17	280 009	HEX BUFFER	"	MC 14049CP	—
M18	280 007	TRIPLE NAND	"	MC 14023CP	—
M19	290 003	TIMER - ASTABLE	SIGNETICS	NE 555V	4
M20	280 006	DUAL J-K FLIP-FLOP	MOTOROLA	MC 14027CP	4
M21	280 006	"	"	"	—
M22	280 008	QUAD NAND	"	MC 14011CP	—
M23	280 008	"	"	"	—

NOTES.

J. W. 1164

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SHEET 17 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M24	290 003	TIMER - MONOSTABLE	SIGNETICS	NE555V	—
M25	270 028	QUAD NAND	NATIONAL	DM 74L03N	1
M26	280 009	HEX BUFFER	MOTOROLA	MC 14049CP	—
M27	290 003	TIMER - ASTABLE	SIGNETICS	NE 555V	—
M28	280 007	TRIPLE NAND	MOTOROLA	MC 14023CP	—
M29	290 003	TIMER - MONOSTABLE	SIGNETICS	NE 555V	—
M30	280 006	DUAL JK FLIP FLOP	MOTOROLA	MC 14027CP	—
M31	280 005	TRIPLE GATE	"	MC 14501CP	1
M32	280 008	QUAD NAND	"	MC 14011CP	—
M33	280 004	14 BIT BINARY COUNTER	"	MC 14020CP	1
M34	NOT USED				
M35	260 013	LINEAR I.C LF 356	NATIONAL	LF 356	1
M36	260025	LINEAR I.C 101 OP AMP	"	LM101	5
M37	260025	"	"	"	—
M38	260025	"	"	"	—
M39	260018	PRECISION REGULATOR		LM399H	1
M40	260025	LINEAR I.C. 101 OP. AMP	NATIONAL	LM101	—
M41	260025	" " "	"	"	—
M42	280008	QUAD NAND	MOTOROLA	MC 14011CP	—
M43	280009	HEX BUFFER	"	MC 14049 CP	—
M44	280006	DUAL JK FLIP-FLOP	"	MC 14027 CP	—
M45	280011	DUAL D FLIP-FLOP	"	MC 14013 CP	—
M46	280008	QUAD NAND	"	MC 14011 CP	—

NOTES.

J. W. 1164

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TITLE 1051 A-1)

DRAWING NUMBER 400094

SHEET 18 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M47	260 017	LINEAR I.C 15V REGULATOR	MOTOROLA	MC78M15	2
M48	260 017	"	"	"	—
M49	260026	OP. AMP.	NATIONAL	LM212H	1
M50	260 005	LINEAR I.C 5V REGULATOR	MOTOROLA	MC7805	1
Q1	230 019	P MOSFET ENHANCEMENT	G.I	MEM 806	1
Q2	230 002	N FET SWITCH GP	TELEDYNE	U1994E/K4416-18	3
Q3	230 002	"	"	"	—
Q4	230 002	"	"	"	—
Q5	NOT USED				
Q6		MATCHED SET			
Q7	239 018	OF 3 FETS	DATRON SEL. TELEDYNE	U1899E $\Delta R_{ON} < 10\Omega$	1 SET
Q8					
Q9	230 003	N FET SWITCH GP	NATIONAL	U1899E/K4093-18	1
Q10	230 001	JUNCTION FET CURRENT LIMIT DIODE		E506	3
Q11	230 001	"		"	—
Q12	230 001	"		"	—
Q13	NOT USED				
Q14	240 001	SIL NPN GP		BC 184K	11

NOTES.

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J.W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q15	240 001	SIL NPN GP		BC 184K	—
Q16	240 001	"		"	—
Q17		NOT USED			
Q18	240 001	"		"	—
Q19	NOT USED				
Q20	240001	SIL NPN GP		BC 184K	—
Q21	240007	SIL NPN GP	FAIRCHILD	2N 3646	6
Q22	240007	"	"	"	—
Q23	240007	"	"	"	—
Q24	250001	SIL PNP GP		BC 214K	5
Q25	240001	SIL NPN GP		BC 184K	—
Q40	240001	SIL NPN GP		BC 184K	—
Q41	240001	"		"	—
Q42	240011	SIL NPN MED. POWER	FAIRCHILD	BC 338	1
Q43	240 007	SIL NPN GP	"	2N 3646	—
Q44	240 007	"	"	"	—
Q45	240007	"	"	"	—
Q46	240013	SIL NPN GP		BC 184KC	2
Q47	240013	"		"	—
Q48	250001	SIL PNP GP		BC 214K	—
Q49	240001	SIL NPN GP		BC 184K	—

NOTES.

J. W. 1164

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datron ELECTRONICS LTD

TITLE 1051 A-D

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SHEET 20 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
Q50	250 001	SIL PNP GP		BC 214K	—
Q51	240 001	SIL NPN GP		BC 184 K	—
Q52	250001	SIL PNP GP		BC 214K	—
Q53	250001	"		"	—
Q54	NOT USED				
Q55	240 001	SIL NPN GP		BC 184K	—
	450039	UPPER GUARD SHIELD			1
	450 040	LOWER GUARD SHIELD			1
	700 020	SWITCH BUTTON CHROME			3
S1	700 005	SWITCH PCB PUSH ON/OFF	LIPA & ISOSTAT	CD 15 2 POLE	2
S2	700 039	SWITCH PCB MOMENTARY	"	CD 15 2 POLE	1
S3	700 005	SWITCH PCB PUSH ON/OFF	"	CD 15 2 POLE	—
	612 005	STANDOFF M3 x 23 mm	HARWIN		3
	612009	STANDOFF M3 X 12 mm	CAMBION	350-5138-12-07	1
J3	605 002	16 WAY D.I.L SOCKET	ANTIFERENCE	ICN-163-53	1
J7	605 011	16 WAY SOCKET	AMP	H63680-5	2
J8	605 011	"	"	"	—

NOTES.

J. W. 1164

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TITLE 1051 A-D

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SHEET 21 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	620 003	PCB SOLDER TERMINAL	HARWIN	H2105A	11
	602 001	F.S.V TERMINAL	MOLEX	0204 1875	18
	601 002	CONNECTOR TERMINAL	AMP	60803-1	17
	459 138	TRANSISTOR HEAT DISSIPATOR	KDP ES	459138	2
	459 139	HEAT DISSIPATOR	"	459139	1
	410019-10A	PCB			1
	618 001	TRANSISTOR MOUNTING KIT			1
	611 006	M3x10mm POZIPAN	GKN		9
	613 005	M3 SHAKEPROOF	GKN		9
	615 002	M3 NUT	GKN		3
	590 001	SLEEVE BLACK	HELLERMAN	H15 x20mm LG	11
	605059	8WAY DIL SOCKET	ASTRALUX	ICL-083-66T.	4
	605038	16-WAY D.I.L SOCKET	ASTRALUX	ICL163-56T	16
	605037	14-WAY D.I.L SOCKET	"	ICL143-53T	17
	605012	24WAY D.I.L SOCKET	JERMYN	A23-2023Y	1
	613011	6BA NYLON WASHER	NYLONIC ENG Co Ltd	7801	4
	604017	MAINS CONNECTOR	MOLEX	AE 3003	1
	613007	PLAIN WASHER M3			2
	611019	POZIPAN M3x35mm			1
	615010	M3 NYLOCK NUT	GKN		1
	590004.	SLEEVE BLACK	HELLERMAN. ELECTRIC	SLP 15.	A/R

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J.W. 1164

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TITLE 1051 A-D

DRAWING NUMBER 400094

SHEET 22 OF 22

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000 222	2K2 5% 1/4W CARBON	MULLARD	CR25	6
R2	000 222	2K2 "	"	"	—
R3	000 222	2K2 "	"	"	—
R4	000 222	2K2 "	"	"	—
R5	000 222	2K2 "	"	"	—
R6	000 222	2K2 "	"	"	—
R7	000 104	100K 5% 1/4W CARBON	"	"	5
R8	000 104	100K "	"	"	—
R9	000 104	100K "	"	"	—
R10	000 104	100K "	"	"	—
R11	000 104	100K "	"	"	—
R12	000 153	15K 5% 1/4W CARBON	"	"	5
R13	000153	15K "	"	"	—
R14	000153	15K "	"	"	—
R15	000153	15K "	"	"	—
R16	000153	15K "	"	"	—
R17	000472	4K7 5% 1/4W CARBON	"	"	2
R18	000472	4K7 "	"	"	—
R19	000 224	220K 5% 1/4W CARBON	"	"	6
R20	000224	220K "	"	"	—
R21	000 224	220K "	"	"	—
R22	000224	220K "	"	"	—
R23	000224	220K "	"	"	—

NOTES.

J. W. 1164

ISS. 2 ECO 117	3	4							
	ECO 319	ECO 508							
	25.11.76	5.7.77							

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datron ELECTRONICS LTD

TITLE 1051 .5" SPERRY DISPLAY ASSY.

DRAWING NUMBER 400088

SHEET 2 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000224	220K 5% ¼W CARBON	MULLARD	CR25	—
R25	000225	2M2 10% ¼W CARBON	"	"	5
R26	000225	2M2 "	"	"	—
R27	000225	2M2 "	"	"	—
R28	000225	2M2 "	"	"	—
R29	000225	2M2 "	"	"	—
C1	110 013	0.1μF 20% 250V POLYESTER	MULLARD	C280AE/P100K	5
C2	110 013	" "	"	"	—
C3	110 013	" "	"	"	—
C4	110 013	" "	"	"	—
C5	110 013	" "	"	"	—
D1	200001	Si GP		IN4148	7
D2	200001	"		"	—
D3	200001	"		"	—
D4	200001	"		"	—
D5	200001	"		"	—

NOTES.

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TITLE 1051 .5" SPERRY DISPLAY ASSY.

DRAWING NUMBER 400088

SHEET 3 OF 5

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D6	200 001	Si GP		IN4148	—
D7	200 001	"		"	—
Q1	250 009	PNP Si Hi Volt		2N5401	5
Q2	250 009	"		"	—
Q3	250009	"		"	—
Q4	250 009	"		"	—
Q5	250 009	"		"	—
Q6	240 009	NPN Si Hi Volt GP	MOTOROLA	MPSL01	5
Q7	240 009	"	"	"	—
Q8	240009	"	"	"	—
Q9	240009	"	"	"	—
Q10	240 009	"	"	"	—
Q11	250 001	PNP Si GP		BC214K	3
Q12	250 001	"		"	—
Q13	250 001	"		"	—
M1	280 009	Hex. Inverter	Motorola	MC14049CP	1

NOTES.

J. W. 1164

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TITLE 1051 .5" SPEARY DISPLAY ASSY

DRAWING NUMBER 400088

SHEET 4 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
LP1	920 005	FILAMENT LAMP 5V 60mA	G.I.	V683	6
LP2	920 005	"	"	"	—
LP3	920 005	"	"	"	—
LP4	920 005	"	"	"	—
LP5	920 005	"	"	"	—
LP6	920 005	"	"	"	—
	450 003	FUNCTION BLANK	NORWICH PLASTICS		2
	420 013	Ω, KΩ NEGATIVE			1
	420 030	MΩ NEGATIVE			1
	611 014	SCREW No 4 x 3/8" SELF TAPPING			2
	613 005	WASHER M3 SHAKEPROOF			2.
	410018-3	PCB			1
	605038	D.I.L SOCKET 16 PIN	ASTRALUX	ICL 163-S6T	1
	604 003	CONNECTOR STRIP 11 WAY	AMP		3
	800 010	SPERRY SOCKET	SPERRY	CS 353	2
	800 003	SPERRY .5" DISPLAY (888)	"	SP 353	1
	800 012	SPERRY .5" DISPLAY (188)	"	SP 354	1
	630 030	CREPE PAPER TAPE .200"	BRADY	CSR 200	80mm

NOTES.

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TITLE 1051 .5" SPERRY DISPLAY ASSY.

DRAWING NUMBER 400088 SHEET 5 OF 5

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000107	100M 10% ¼W CARBON	ALLEN BRADLEY	CB 1071	1
R2	008016	56K 1% ¼W. MET-GLAZE.	LESA NEOHM	RGP 0207	4
R3	008016	" "	"	"	—
R4	008016	" "	"	"	—
R5	008016	" "	"	"	—
R6	000124	120K 5% ¼W CARBON	MULLARD	CR25	2
R7	000124	120K "	"	"	—
R8		FSV			1
R9		FSV			1
R10	063205	2M ⅜" CERMET POT.	BECKMAN	72P	2
R11		FSV			1
R12		FSV			1
R13	063205	2M ⅜" CERMET POT.	BECKMAN	72P	—
R14	063100	10R "	"	"	1
R15	090014	9K995 .02% MATCHED	MANN	3C-B	2
R16		50K .02% PAIR			
R17		FSV			1
R18	000102	1K 5% ¼W CARBON	MULLARD	CR25	1
R19	063500	50R ⅜" CERMET POT	BECKMAN	72P	1
R20	090014	9K995 .02% MATCHED	MANN	3C-B	—
R21		50K .02% PAIR			
R22	000220	22R 5% ¼W CARBON	MULLARD	CR25	1
R23	000154	150K "	"	"	1

NOTES.

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ECO	125	ECO 203	ECO 203		ECO 276	ECO. 693	ECO 760	773/751	768
	5.11.75	10.3.76	10.3.76		9.9.76	30.5.78	8 NOV 78	24 Nov 78	26 FEB 79

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TITLE: 1051 / 1059 — RATIO AMPL 1V I/P

DRAWING NUMBER: 400091

SHEET 7 OF 6

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	063203	20K 3/8" CERMET POT	BECKMAN	72P	1
R25		NOT USED			
R26		NOT USED			
R27	NOT USED				
R28	000 103	10K 5% ¼W CARBON	MULLARD	CR25	3
R29	000 103	10K "	"	"	—
R30	000 272	2K7 "	"	"	1
R31	000 182	1K8 "	"	"	1
R32	000103	10K "	"	"	—
C1	120021	0·47μF 10% POLYCARB.	ASHCROFT	A2B4711B	2
C2	120021	0·47μF "	"	"	—
C3	102102	1000pF CER. DISC	ERIE	801	2
C4	102102	"	"	"	—
C5	120013	.15μF 10% 63V POLYCARB.	ADVANCE	CMD4	2
C6	120013	"	"	"	—
C7		NOT USED			
C8	101103	.01μF "	ERIE	801	3
C9	101103	"	"	"	—
C10	101103	"	"	"	—

NOTES.

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TITLE 1051 1059 RATIO AMP² 1V I/P

DRAWING NUMBER 400091

SHEET 3 OF 6

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D1	200008	LOW LEAKAGE	FAIRCHILD	IN458A	4
D2	200008	"	"	"	—
D3	200008	"	"	"	—
D4	200008	"	"	"	—
D5	200001	Si GP		IN4148	4
D6	200001	"		"	—
D7	200001	"		"	—
D8	200001	"		"	—
M1	260026	LINEAR LM212H OR AMP.	NATIONAL	LM212H	2
M2	260026	"	"	"	—
M3	260027	LINEAR I.C.	FAIRCHILD	µA714 HC	1
M4	220005	OPTO-ISOLATOR FCD820	FAIRCHILD	FCD 820	1
Q1	240001	Si NPN GP		BC 184K	3
Q2	240001	"		"	—
Q3	240001	"		"	—

NOTES.

J. W. 1164

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TITLE 1051 1059 RATIO AMPL. IV I/P

DRAWING NUMBER 400091

SHEET 4 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
K1	330003	RELAY 28v 3.2K BIF.	POTTER & BRUMFIELD	R10-E1-L2-S3.2K	1
	602007	RELAY SOCKET	POTTER & BRUMFIELD	A11-1	1
	630005	CLIP	" "	P28-1	1
S1	700019	SLIDE SWITCH	SIEMENS	C42315-A60-A1	1
	410015-6	P.C.B	DATRON		1
	602001	F.S.V. TERMINAL	MOLEX	02-04-1875	11
	612006	M3 STANDOFF x9·5mmLG.	HARWIN		4
	611004	SCREW M3x6mm POZI PAN	G.K.N		4
	601002	CONNECTOR TERMINAL	AMP	60803-1	5
	620003	SOLDER TERMINAL	HARWIN	H-2105A	11
	510333	7/.2 P.V.C. INSUL. WIRE-ORANGE			A/R
	510222	7/.2 P.V.C INSUL. WIRE-RED			A/R
	510666	" -BLUE			A/R
	510555	" -GREEN			A/R
	510111	" -BROWN			A/R
	510999	" -WHITE			A/R
	510000	" -BLACK			A/R
	510888	" -GREY			A/R
	510001	" -PINK			A/R

NOTES.

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J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	521002	16/.2 P.V.C INSUL. WIRE - WHITE/RED			A/R
	521003	" - ORANGE/BLK			A/R
	521004	" - RED/BLK			A/R
	510777	7/.2 " - VIOLET			A/R
	602003	SNAP CONNECTOR	AMP	60983-1	16
	590001	SLEEVE	HELLERMAN	HIS-15	12
	590011	SLEEVE	"	HIS	A/R
	604006	5 WAY PLUG	PYE	M5P	1
	605007	5 WAY SOCKET	"	M5S	1
	606001/A	LOCKING HOOD (PANEL MT.)	"	MHN	1
	606001/B	LOCKING HOOD (CABLE MT.)	"	MHN	1
	606002	NUT	"	MN	1
	606003	WASHER	"	MLW	1

NOTES.

J. W. 1164

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TITLE 1051 1059 RATIO AMPL 1v 1/P

DRAWING NUMBER 400091

SHEET 6 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	063203	20K POT CERMET	BECKMAN	72P	3
R2	063203	20K " "	"	"	–
R3	011003	100K 1% 1/8W M/F	WELWYN	4033C	2
R4	011003	100K 1% 1/8W M/F	"	"	–
R5	063202	2K POT CERMET	BECKMAN	72P	2
R6	063202	2K " "	"	"	–
R7	050015	100K .25% 1/8W M/F	ERG	EE125	2
R8	050015	100K " " "	"	"	–
R9		FSV			1
R10		FSV			1
R11	063205	2M POT CERMET	BECKMAN	72P	1
R12, R13	090014	9K995/50K .02%	MANN	3C-B	1 MATCHED PAIR
R14	000102	1K 5% 1/4W CARBON	MULLARD	CR25	1
R15	063203	20K POT CERMET	BECKMAN	72P	–
R16	000394	390K 5% 1/4W CARBON	MULLARD	CR25	1
R17	000100	10R 5% 1/4W CARBON	"	"	1
R18	000822	8K2 " " "	"	"	1
R19		NOT USED			
R20		NOT USED.			
R21	000103	10K 5% 1/4W CARBON	MULLARD	CR25	3
R22	000103	10K " " "	"	"	–
R23	000272	2K7 " " "	"	"	1

NOTES.

J. W. 1164

ISS. 2 C	3	4	5	6				
ECO 269	ECO 277	ECO. 694	ECO 760	775/751.				
26.8.76	14-9-76	30.5.78	8 NOV 78	24-NOV-78				

DATE 25.8.76

DRAWN BY M.J.D.

CHECK

NEXT DRAWING

PROD APP. 2.2.77

datron ELECTRONICS LTD

TITLE 10V/100V RATIO AMP 1051

DRAWING NUMBER 400125

SHEET 2 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R24	000182	1K8 5% ¼W CARBON	MULLARD	CR25	1
R25	000103	10K " " "	"	"	–
R26	000226	22M 10% " "	ALLEN BRADLEY	CB10	1
R27		FSV			1
AN1	090018	THIN FILM NETWORK	ALLEN BRADLEY	FN207	2
AN2	090018	" " "	" "	"	–
C1	120021	0·47μF 10% 63V POLYCARB.	ASHCROFT	A2B4711B.	2
C2	120021	0·47μF " " "	"	"	–
C3	102102	1nF 500V CER. DISC	ERIE	801	1
C4	120013	·15μF 10% 63V POLYCARB.	ADVANCE	CMD4	1
C5					
C6	101103	10nF 250V CER DISC	ERIE	801.	3
C7	101103	10nF 250V " "	"	"	–
C8	101103	10nF 250V CER. DISC.	ERIE	801.	–
D1	200008	Si. LOW LEAKAGE	FAIRCHILD	IN458A	4
D2	200008	Si. " "	"	"	–

NOTES.

J. W. 1164

ISS.									
SEE SHT 2									

DATE 25-8-76

DRAWN BY M. J. D.

CHECK

NEXT DRAWING

datron ELECTRONICS LTD

TITLE 10V/100V RATIO AMP. 1051

DRAWING NUMBER 400125

SHEET 3 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
D3	200008	Si. LOW LEAKAGE	FAIRCHILD	IN458A	-
D4	200008	Si. " "	"	"	-
D5	200001	Si. G.P.		IN4148	4
D6	200001	Si. "		"	-
D7	200001	Si. "		"	-
D8	200001	Si. "		"	-
Q1	240001	Si NPN GP		BC184K	3
Q2	240001	Si " "		"	-
Q3	240001	Si " "		"	-
M1	260026	212 OP. AMP.	NATIONAL	LM212H.	1
M2	260027	LIN. I.C.	FAIRCHILD	µA714 HC.	1
M3	220005	OPTO ISOLATOR	FAIRCHILD	FCD 820	1
S1	700019	SLIDE SWITCH	SIEMENS	C42315-A60-A1	1
RL1	330003	RELAY 28V 3K2 BIF.	POTTER & BRUMFIELD	R10-E1-L2-S3.2K	1
	602007	RELAY SOCKET	" "	A11-1	1
	630005	CLIP	" "	P28-1	1
	410037-2	P.C.B.			1

NOTES.

ISS.								
SEE SHT. 2								

DATE 25-8-76
DRAWN BY M.J.D
CHECK
NEXT DRAWING

datron ELECTRONICS LTD

TITLE 10V/100V RATIO AMP. 1051

DRAWING NUMBER 400125

SHEET 4 OF 6

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	601002	SNAP CONNECTOR	AMP	60803-1	7
	602001	FSV TERMINAL	MOLEX	02-04-1875	7
	620003	SOLDER TERMINAL	HARWIN	H2105A	11
	612006	STANDOFF M3 x 9.5 LG.	"		4
	540002	22SWG. TINNED Cu. WIRE			A/R
	590001	SLEEVE,	HELLERMAN	H15 x 20MM LG.	14
	590002	SLEEVE	HELLERMAN	H30-20	1
	510222	7/.2 P.V.C. INSUL. WIRE - RED			A/R
	510666	" " " " - BLUE			A/R
	510555	" " " " - GREEN			A/R
	510111	" " " " - BROWN			A/R
	510999	" " " " - WHITE			A/R
	510000	" " " " - BLACK			A/R
	510888	" " " " - GREY			A/R
	511001	" " " " - PINK			A/R
	521002	16/.2 " " " WHT./RED			A/R
	521003	" " " " OR/BK			A/R
	521004	" " " " RED/BK			A/R
	602003	SNAP RECEPTACLE	AMP	60983-1	18
	590011	BLACK SLEEVING	HELLERMAN	H15	A/R
	510333	7/.2 P.V.C. INSUL. WIRE - ORANGE			A/R
	510777	" " " " - VIOLET			A/R

NOTES.

J.W. 1164

ISS.								
SEE SHT. 2								

DATE 25-8-76

DRAWN BY M.J.D

CHECK

NEXT DRAWING

datron ELECTRONICS LTD

TITLE 10V/100V RATIO AMP 1051

DRAWING NUMBER 400125

SHEET 5 OF 6

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
	604006	5 WAY PLUG	PYE	MSP	1
	605007	5 WAY SOCKET	"	MSS	1
	606001/A	LOCKING HOOD (PANEL MT.)	"	MHN	1
	606001/B	LOCKING HOOD (CABLE MT.)	"		1
	606002	NUT	"	MN	1
	606003	WASHER	"	MLW	1

NOTES.

ISS.								
SEE SHT 2.								

DATE 25-8-76

DRAWN BY M.J.D.

CHECK

NEXT DRAWING

datron ELECTRONICS LTD

TITLE 10V/100V RATIO AMP 1051

DRAWING NUMBER 400125

SHEET 6 OF 6

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
R1	000104	100K 5% ¼W CARBON	MULLARD	CR25	6
R2	000104	100K "	"	"	–
R3	000104	100K "	"	"	–
R4	000563	56K "	"	"	1
R5	000104	100K "	"	"	–
R6	000104	100K "	"	"	–
R7	000104	100K "	"	"	–
D1	200005	DIODE HG 5009	HUGHES	HG5009	2
D2	200005	" "	"	"	–
C1	150012	0.1μF 35V 20% DIPPED TANT.	UNION CARBIDE	KRIE35	1
C2	102102	1kpF 500V CER DISC	ERIE	801	1
	601002	CONNECTOR TERMINAL	AMP	60803-1	4
M1	280014 *	TRI-STATE HEX BUFFER		80C95, COMMERCIAL	7
M2	290003	TIMER MONOSTABLE	SIGNETICS	NE555V, "	1
M3	280001	QUAD 2 I/P MULTIPLEXER		74C157, "	1
M4	280008	QUAD NAND		14011 "	2
M5	280014 *	TRI-STATE HEX BUFFER		80C95 "	–
M6	280014 *	"		" "	–
M7	280008	QUAD NAND		14011 "	–
M8	280009	HEX INVERTER		14049 "	1

NOTES.

ISS	2	3	4	5	6	7	8	9	10
	ECO 122	ECO 207	234	310	507	559	558	645	733
				16-12-76	5.7.77	23.9.77	23.9.77	30-3-78	31-8-78

DATE 8/76
DRAWN BY JW
CHECK FJH
NEXT DRAWING PROD/AD. 2.2.77

datron ELECTRONICS LTD

TITLE 1051 1059 BCD OUTPUT OPTION B04

DRAWING NUMBER 400095

SHEET 2 OF 3

J. W. 1164

DESIGNATOR	DATRON PART No.	DESCRIPTION	PRINCIPAL MANUFACTURER	MANUFACTURER'S PART No.	No. USED Per Assy.
M9	280015	TRI-STATE QUAD LATCH		74C173, COMMERCIAL	5
M10	280015	"		" "	—
M11	280015	"		" "	—
M12	280015	"		" "	—
M13	280015	"		" "	—
M14	280014 *	TRI-STATE HEX BUFFER		80C95 "	—
M15	280014 *	"		" "	—
M16	280014 *	"		" "	—
M17	280014 *	"		" "	—
	590004	SILICON RUBBER SLEEVING	1·5 ID		A/R
	540002	22 SWG TINNED CU WIRE			A/R
	410027-6	PRINTED CIRCUIT BOARD			1
	604001	50 WAY PLUG (CABLE MTG.)	AMPHENOL	57-30500	1
	605001	50 WAY AMP. SKT. (PANEL MNT)	AMPHENOL	57-40500	1
	605037	14 WAY D.I.L. SKT.	ASTRALUX	ICL 163-56T	2
	605038	16 WAY D.I.L. SKT	"	ICL 143-53T	14
	605059	8 WAY D.I.L SOCKET	"	ICL 083-S6T	1
J7	604010	16 WAY AMP MALE CON.	AMP	1-163749-5	2 SETS
J8	604010	"	"	"	—

NOTES. * ALTERNATIVE 280024 TRI STATE HEX BUFFER MOTOROLA MC14503

DATE	8/76
DRAWN BY	MW
CHECK	
NEXT DRAWING	

datron ELECTRONICS LTD

TITLE 1051 1059 BCD OUTPUT OPTION B04

DRAWING NUMBER 400095 SHEET 3 OF 3

ISS.	SEE	SHEET	2

J. W. 1164

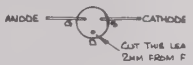
DRAWING No. 400087

FIRST USED ON 1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

Q51 FITTED AS SHOWN WITH DOTT LEAD REMOVED AS SKETCH BELOW



P.C.BOARD 410003-11

M9 TO M14 MOUNTED ON 6WAY SOCKETS 605066-60FF

NYLON WASHER 613011

TOTAL N° OF WASHERS 14 & THEIR POSITIONS

M1,M2, M6&M8 MOUNTED ON 18 WAY DIL SOCKETS. 605038 - 40FF

M3 M4 M5&M7. MOUNTED ON 14 WAY DIL SOCKETS 605039-40FF

LINK TO BE FITTED ON UNDERSIDE OF PRINTED CIRCUIT BOARD (TRACK SIDE)

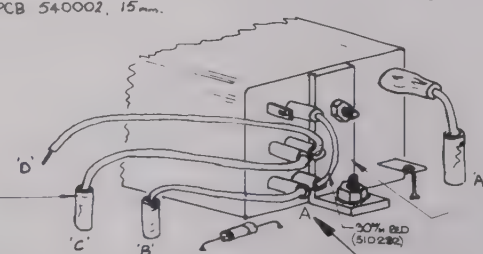
SHROUD 630026 (NUT & WASHER NOT FITTED)

RELAY WIRING (RED 510222)

WIRE TO PIN 'A', 30mm
'B', 45 mm
'D', 65 mm
'C', 60 mm

WIRE LINK TO PCB 540002, 15mm.

RELAY WIRING SKETCH.



9 OFF SLEEVES (M2 - 590001)

I/P CABLE ASSY 400064

6 OFF M3 X 22mm STANDOFF 612005

5 OFF P.T.F.E. STANDOFF 620002

WIRE 65mm, RED 510222

RELAY BRKT (453112)
SCREW M3x6 POZI PAN (611006)
SHAKE PROOF M3 (613005)
NUT M3 (613002)
NUT 3-48 UNC. (615006)

DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES
TRACED	APPROVED	MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES DECIMAL TO 2 PLACES FRACTIONAL
DATE 24-10-78	DATE	SCALE NOT TO BE SCALED	METRIC DIMENSIONS DECIMAL TO 2 PLACES DECIMAL TO 1 PLACE WHOLE DIMENSIONS UNLESS OTHERWISE STATED

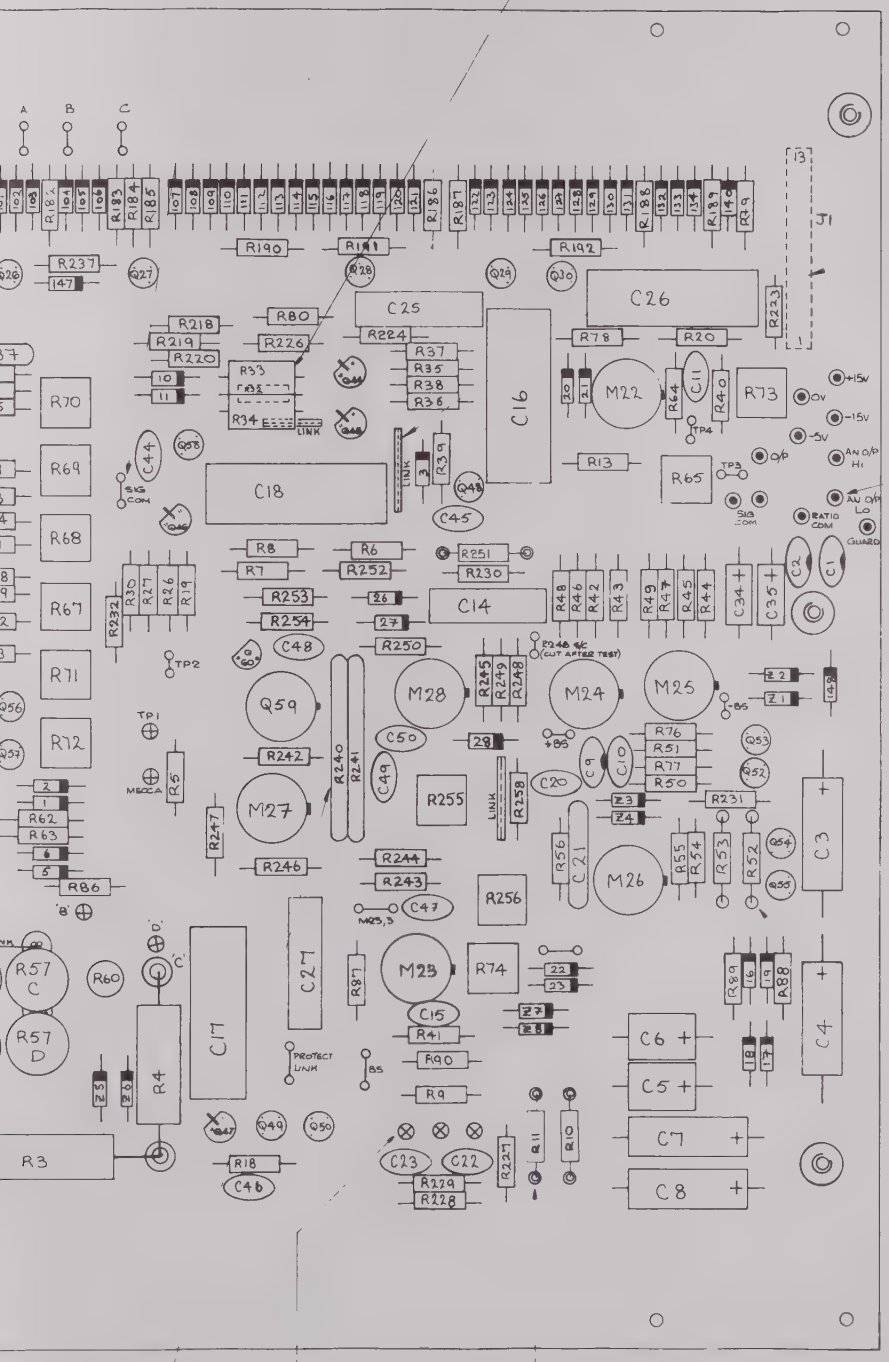
JW116

5	6	7

ALL BURRS TO BE REMOVED

TEST POINT LOOPS
24 SWG BTC WIRE
540001

SLEEVED WIRE LINK



4 OFF SLEEVED LINK
(540002/590004)

J1&J2 FITTED TO UNDERSIDE OF PCB

11 OFF CONNECTOR
601002

NOTES:

1. SLEEVE ALL IN458A's WITH 590004.
2. FIT UPPER GUARD SHIELD (450009) WITH 6 OFF POSI CSK SCREWS M3×6 (611007). FIT LOWER GUARD SHIELD (450010) WITH 6 OFF POSI PAN SCREWS M3×10 (611006) AND 6 OFF M3 SHAKEPROOF WASHERS (613006).

4 OFF
INSULATING BEAD 630036

RESISTORS STUCK TOGETHER WITH 1512

10 OFF
TERMINAL RIVET
620003

6 OFF
F.S.V. TERMINAL
602001

ISS.	CHANGES
35	ECO 797, INCLUSION OF LOW NOISE FRONT END. 10/10/78 ECO 798.
36	ECO 808 D7 200008 DELETED D51 ADDED 230002. 4 JAN 79 W.O.S
37	ECO 845 PARTS LIST MOD 6-4-79

ANGULAR ± °
.005
.010
1·64
1mm
2mm
4mm

MATERIAL

FINISH

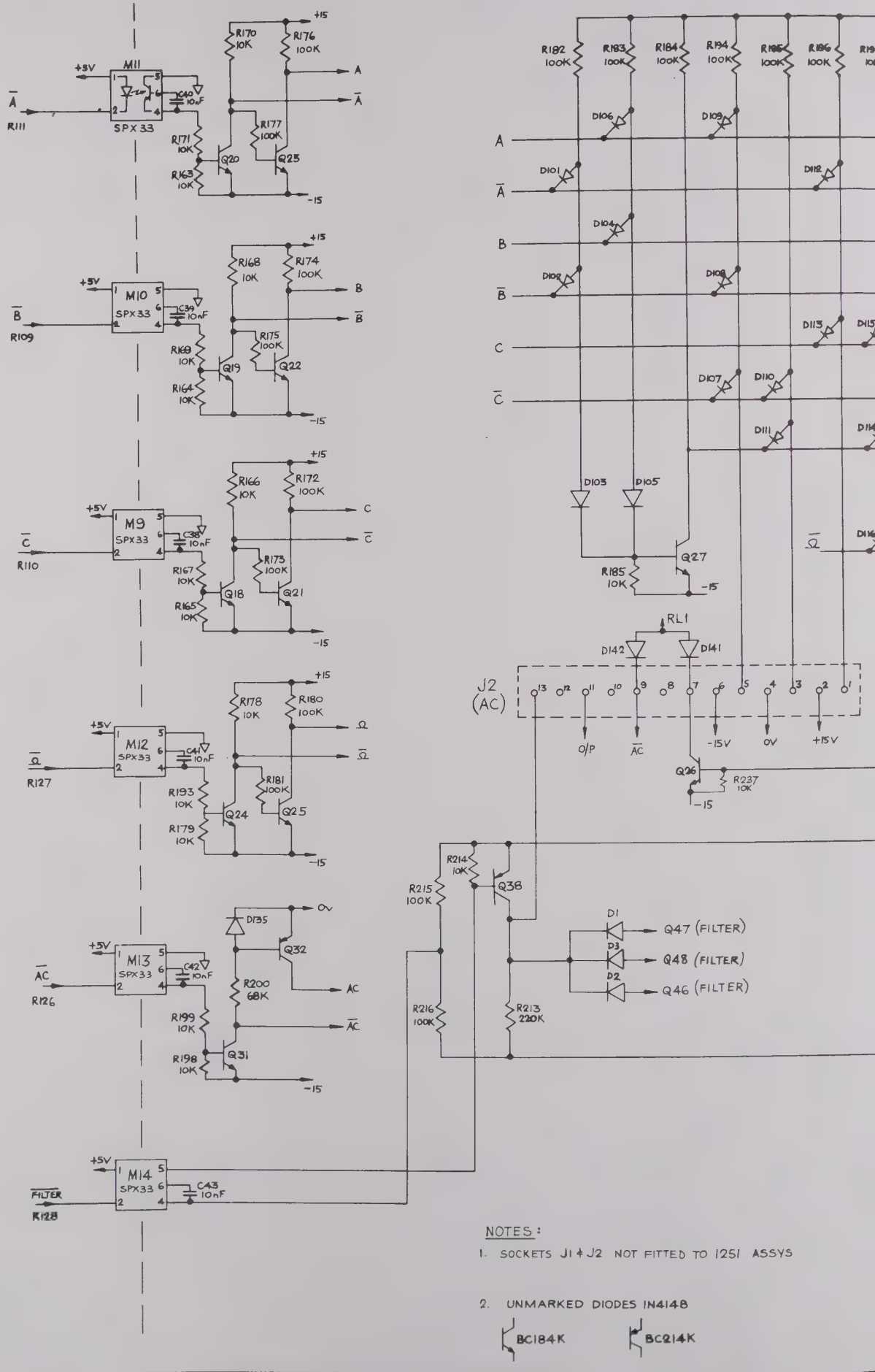
datron ELECTRONICS LTD. NORWICH.

TITLE 1051 DC ISOLATOR

DRAWING No. 400087

DRAWING SIZE A1

SHEET 1 of 25

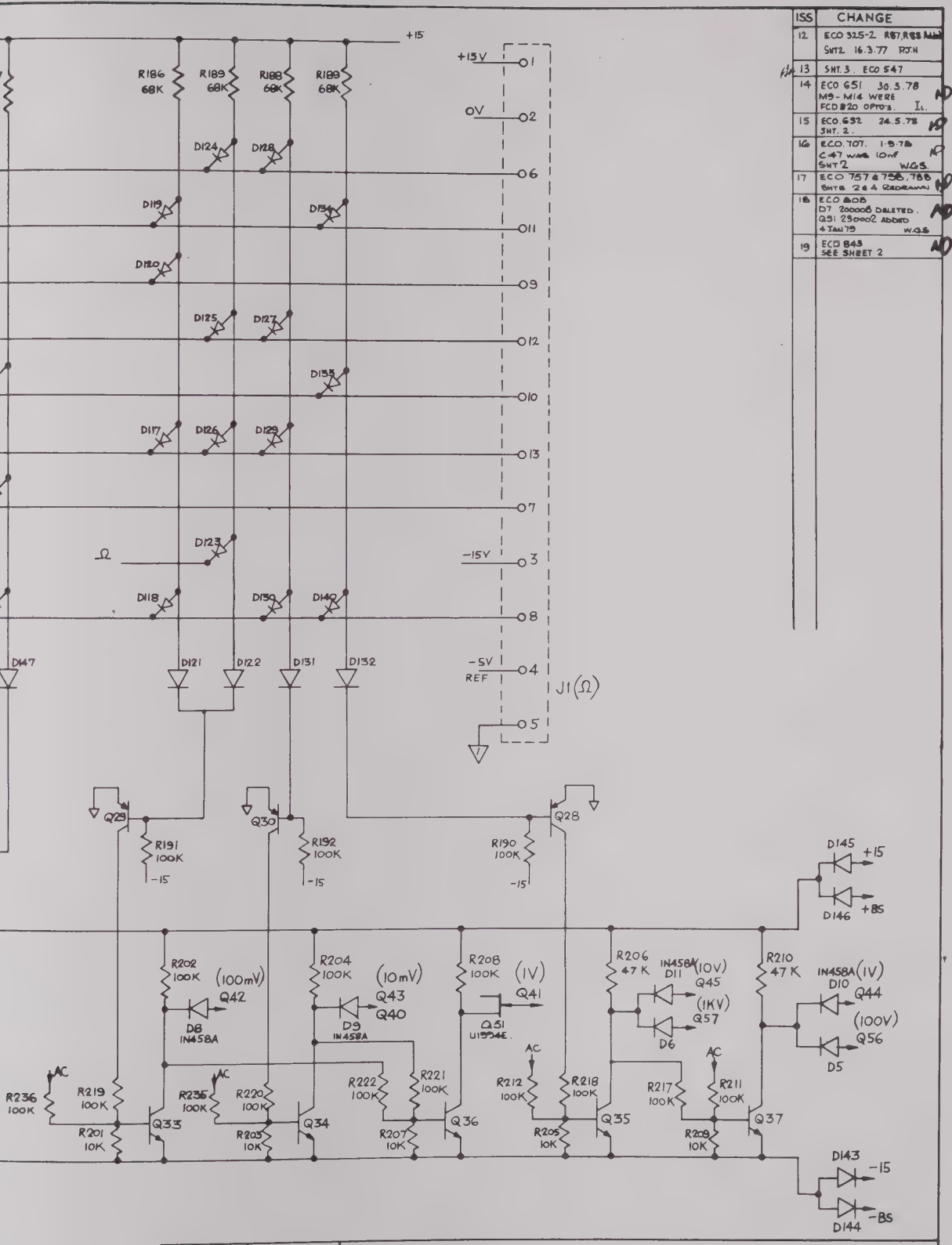


NOTES:

1. SOCKETS J1 & J2 NOT FITTED TO 1251 ASSYS

2. UNMARKED DIODES IN4148

BC184K BC214K



ISS	CHANGE
12	ECO 325-2 R87,R88 M... SHT2 16.3.77 RJH
13	SHT. 3. ECO 547
14	ECO 651 30.5.78 M9 - M14 WERE FCD820 OPTO's. IL.
15	ECO. 652 24.5.78 SHT. 2.
16	ECO. 707. 1.9.78 C47 was 10nF SHT 2 W.G.S.
17	ECO 757 & 758, 788 SHTS 2 & 4 REDRAWN
18	ECO 808 D7 200008 DELETED. Q51 290002 ADDED 4 JAN 79 W.G.S.
19	ECO 843 SEE SHEET 2

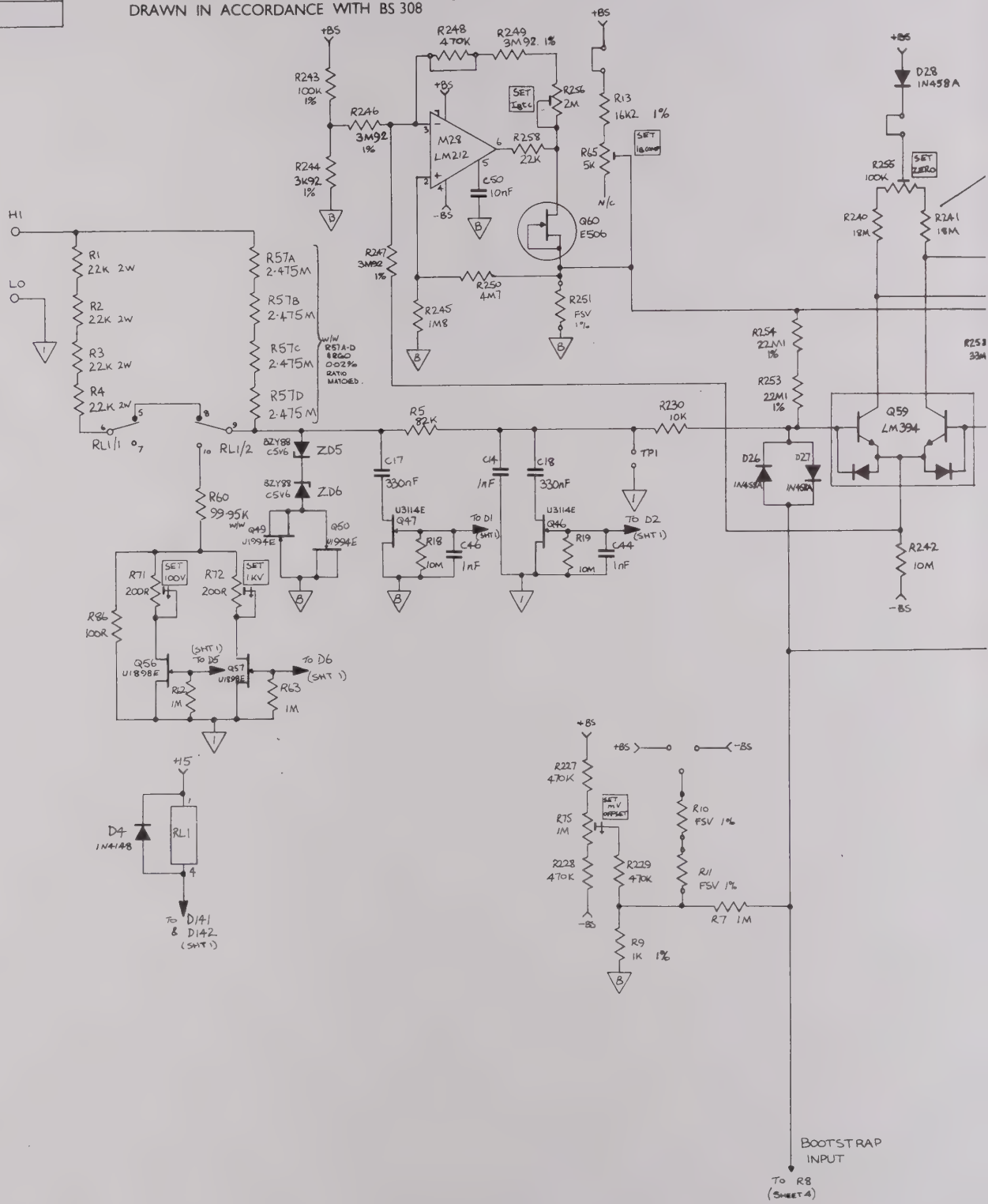
REVISION	DATE	datron ELECTRONICS LTD.	
	24.10.74	R&D	1051 / 1251 D.C. ISOLATOR RANGE DECODING.
1 SEE E.C.O.	11.4.75	CHECKED	
2 E.C.O. 78	1/8/75	PROD. K.A. Dunn 2.2.77	430019
3 E.C.O. 119			SHEET 1 OF 4

DRAWING No. 430019

FIRST USED ON

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES	ANGULAR ±
MJH		MILLIMETRES	INCH DIMENSIONS	
TRACED	APPROVED		DECIMAL TO 3 PLACES ±	.005
		SCALE	DECIMAL TO 2 PLACES ±	.010
DATE 19 10 78	DATE	NOT TO BE SCALED	FRACTIONAL ±	1/64
			METRIC DIMENSIONS	
			DECIMAL TO 2 PLACES ±	1mm
			DECIMAL TO 1 PLACE ±	2mm
			WHOLE DIMENSIONS ±	4mm
			UNLESS OTHERWISE STATED	

5	6	7

ALL BURRS TO BE REMOVED

NOTES

1. ALL RESISTORS 5% ¼W CARBON UNLESS OTHERWISE STATED.

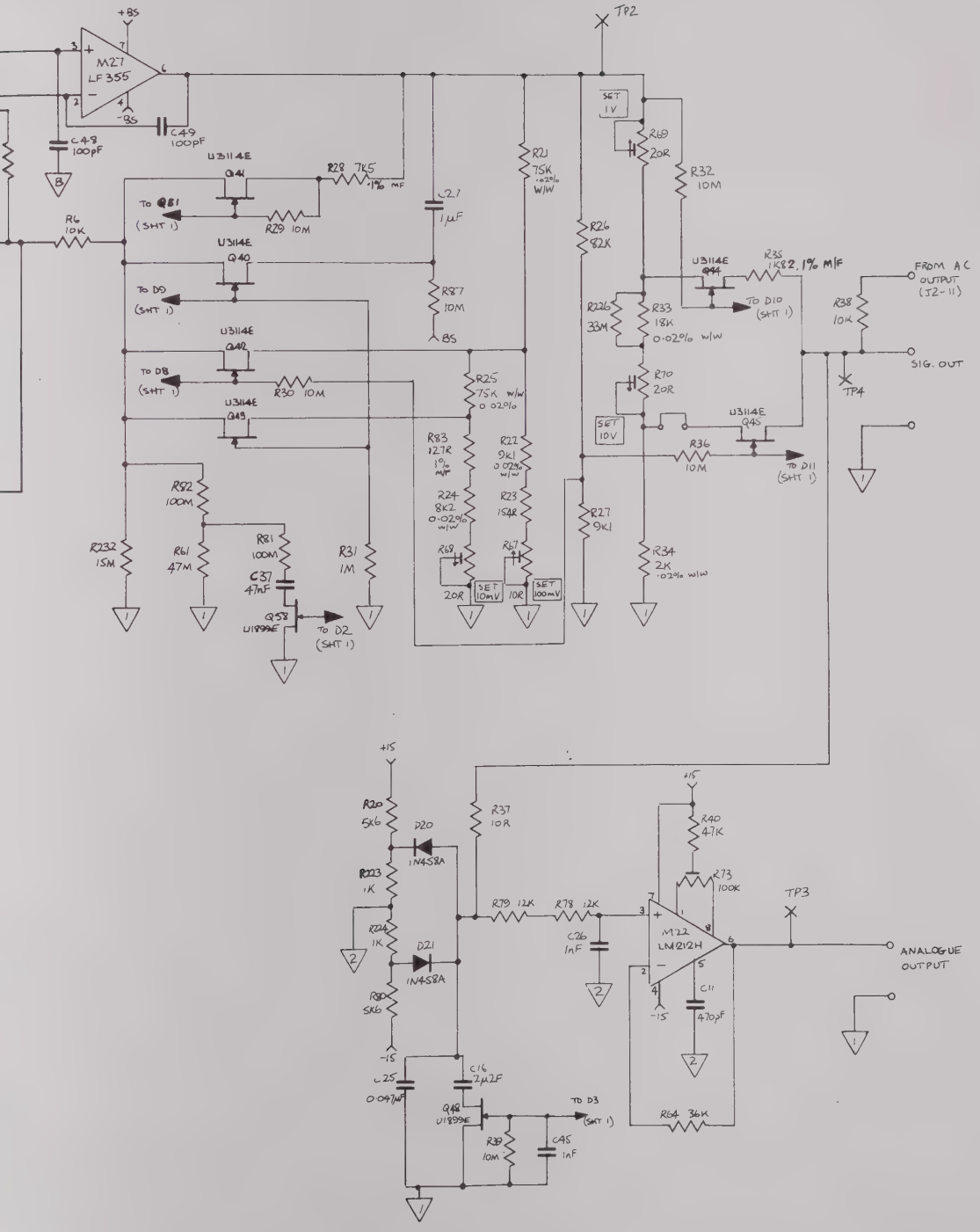
ISS.	CHANGES
17	REDRAWN ECO 757, 758 747, 788
18	ECO 808 SEE SHEET 1
19	Q56, Q57 WERE U1899E SELECTED ECO 848 6.4.79 IL

1 MECCA

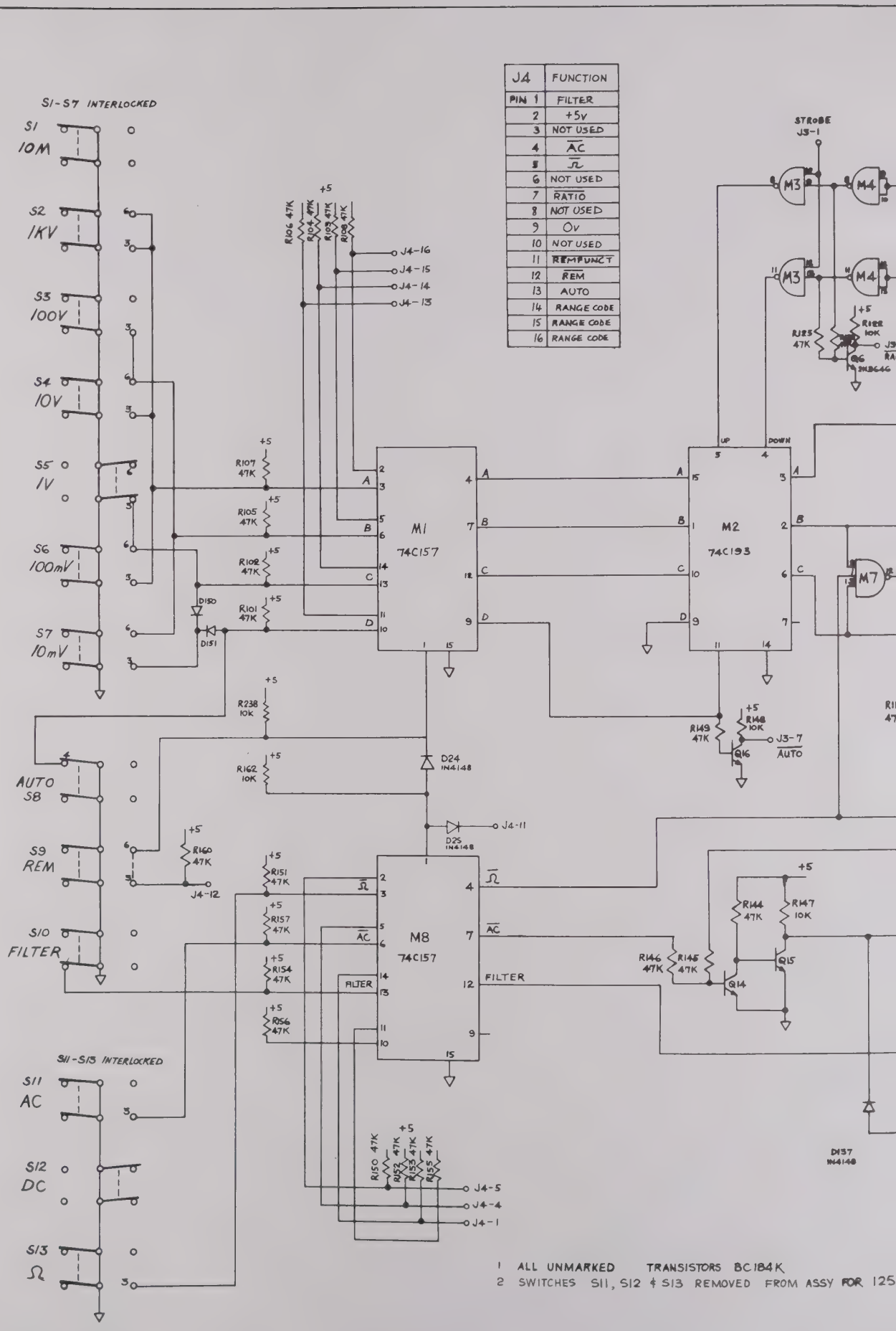
B - BOOTSTRAPPED SUPPLY

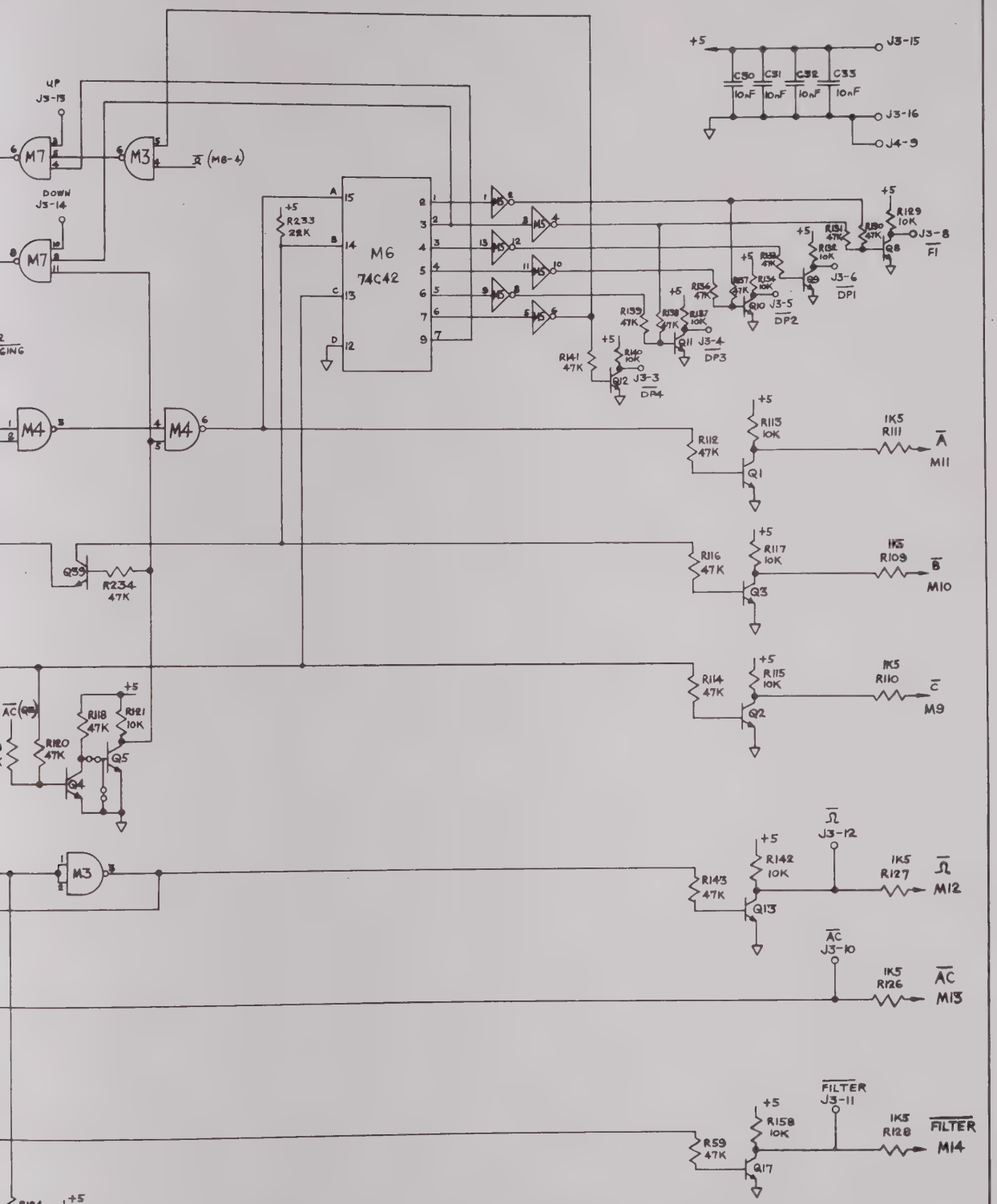
2 - ANALOGUE COMMON

R240, R241 0.2% RATIO MATCHED PAIR



MATERIAL	datron ELECTRONICS LTD. NORWICH.		DRAWING SIZE A1
FINISH	TITLE 1051 D.C. ISOLATOR - ANALOGUE	DRAWING No. 430019	SHEET 2 OF 4


J4 FUNCTION
PIN 1 FILTER
2 +5V
3 NOT USED
4 AC
5 Ω
6 NOT USED
7 RATIO
8 NOT USED
9 0V
10 NOT USED
11 REMFUNCT
12 REM
13 AUTO
14 RANGE CODE
15 RANGE CODE
16 RANGE CODE
S1-S7 INTERLOCKED
S1 10M
S2 1KV
S3 100V
S4 10V
S5 1V
S6 100mV
S7 10mV
S8 AUTO
S9 REM
S10 FILTER
S11-S13 INTERLOCKED
S11 AC
S12 DC
S13 Ω
M1 74C157
M2 74C193
M3
M4
M7
M8 74C157
STROBE J3-1
UP
DOWN
J4-16
J4-15
J4-14
J4-13
J4-11
J4-12
J4-5
J4-4
J4-1
J3-7 AUTO
D24 IN4148
D25 IN4148
D137 IN4148
D150
D151
Q13 2N3644
Q14
Q15
Q16
FILTER
1 ALL UNMARKED TRANSISTORS BC184K
2 SWITCHES S11, S12 & S13 REMOVED FROM ASSY FOR 125

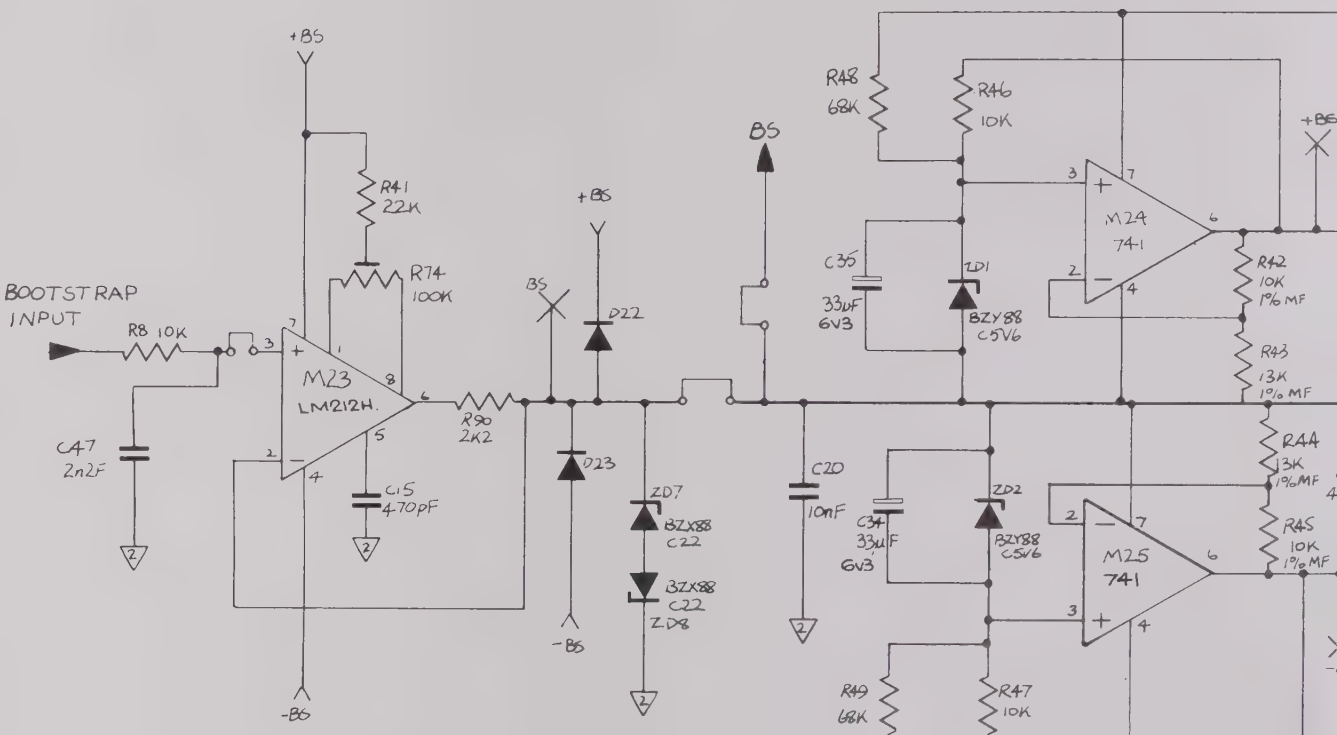


ISS	REVISION	DATE	datron ELECTRONICS LTD		
12 Size B/W 1					
13 ECO 547 27.9.77		28 10 74	R&D	1051 / 1251 D.C. ISOLATOR RANGE LOGIC	
14 ECO 651 SHT. 1					
15 ECO 652 SHT. 2	1 E.C.O. 42	1/5/75	CHECK		
17 ECO 787 18 ECO 808 SHTS 2&4	2 E.C.O. 88	27/8/75	PROD L.A.B. 2.2.77	430019	SHEET 3 OF 4
19 ECO 843 SHT. 2	3 ECO 131	2/1/76			

DRAWING No.	
430019	
FIRST USED ON	

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES ANGULAR ± ½°	MATERIAL
MDA		MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64	
TRACED	APPROVED	SCALE	METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ∓ 4mm	FINISH
DATE 20·10·78	DATE	NOT TO BE SCALED	UNLESS OTHERWISE STATED	

4 | 5 | 6

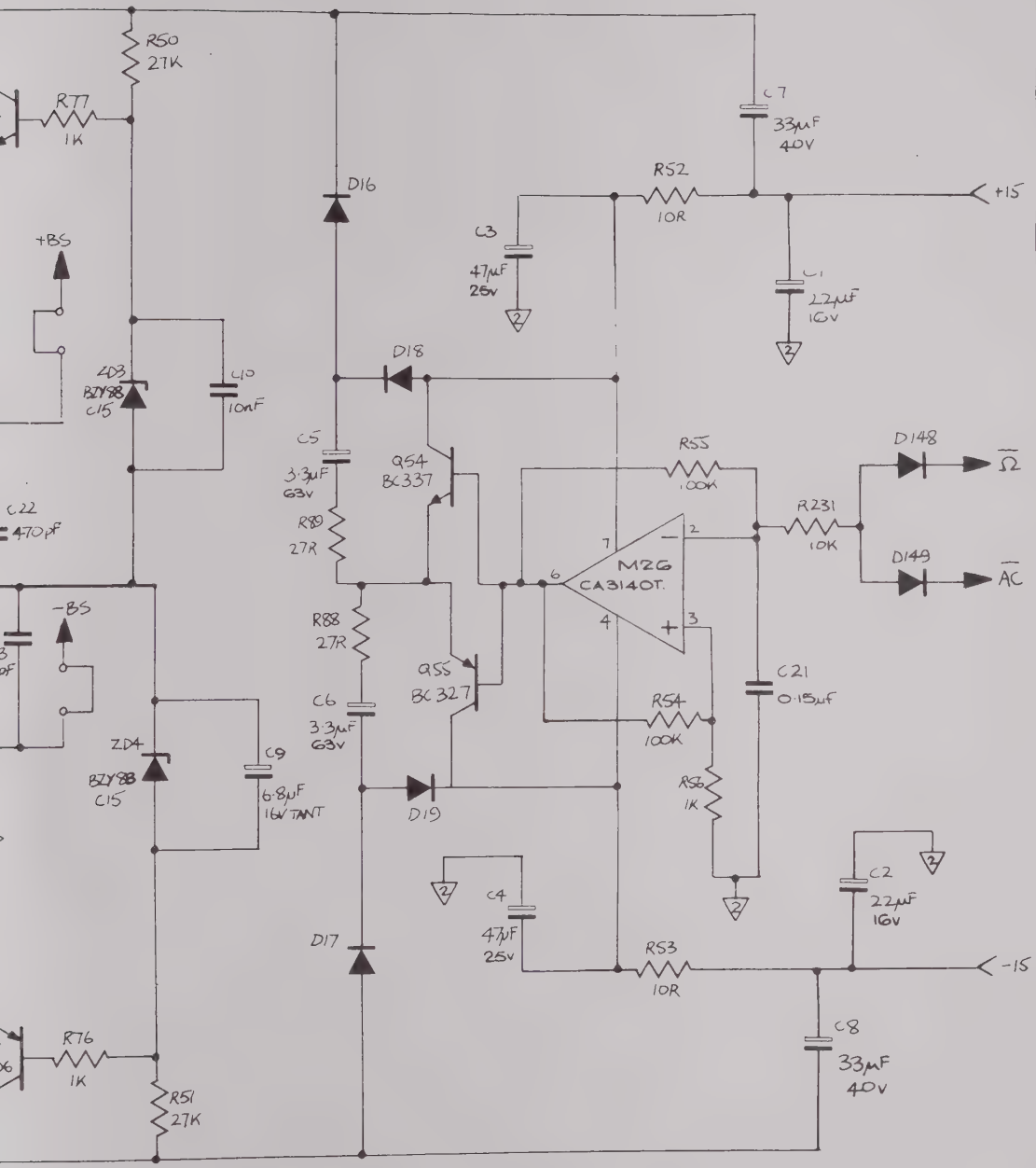
BURRS TO BE REMOVED

NOTES

1 ALL RESISTORS 5% ¼W CARBON UNLESS OTHERWISE STATED

2 ALL DIODES IN4148 UNLESS OTHERWISE STATED.

ISS.	CHANGES
17	REDRAWN ECO 757, 758 747, 788 AD
18	ECO 808 SEE SHEET 1 AD
19	ECO 843 SEE SHEET 2 AD



datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE 1051 D.C. ISOLATOR - BOOTSTRAP

DRAWING No. 430019

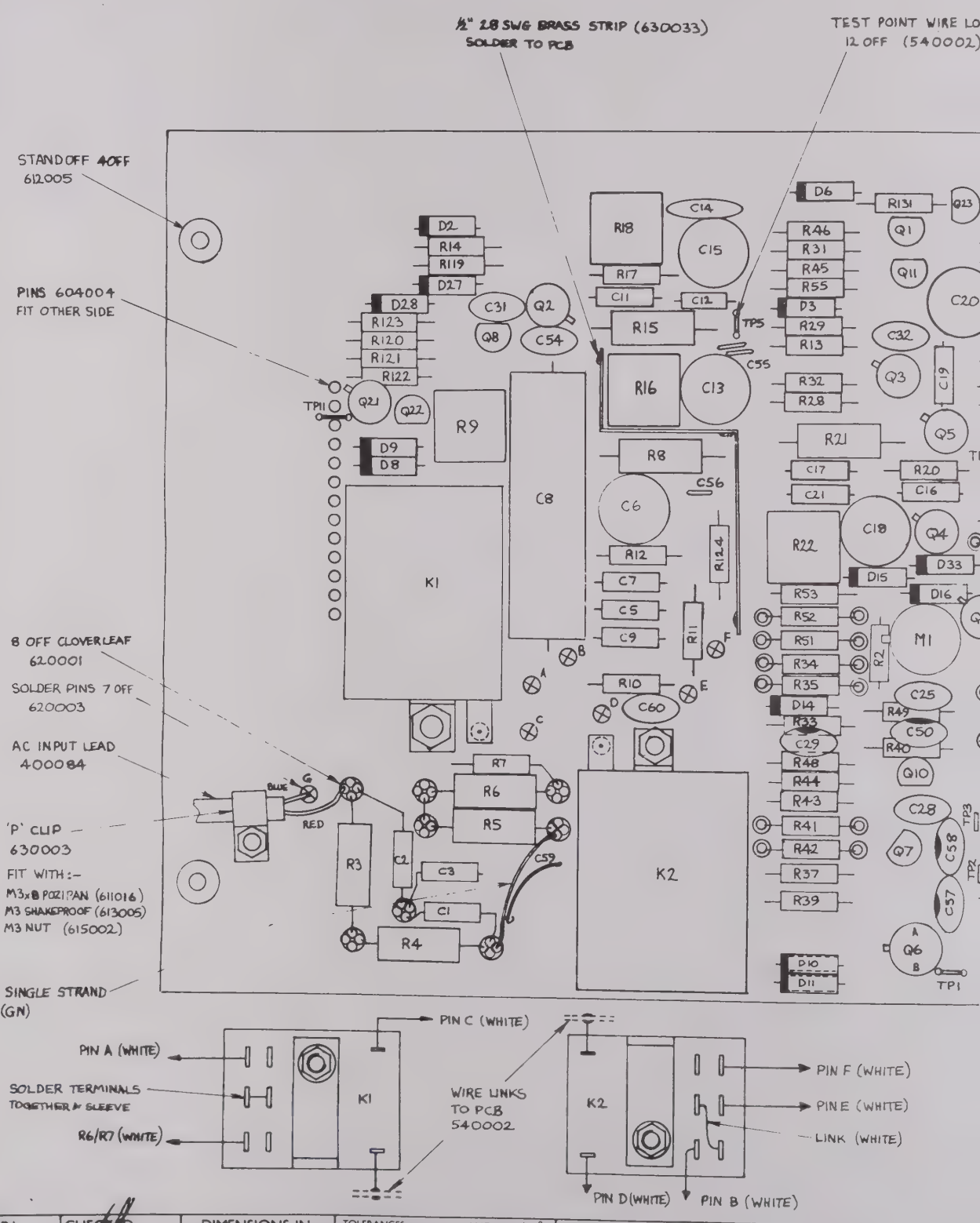
SHEET 4 of 4

DRAWING No. 400037

FIRST USED ON 1041

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN	CHECKED.	DIMENSIONS IN	TOLERANCES ANGULAR ± ½°	MATERIAL
TRACED	APPROVED	MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ∓ 4mm UNLESS OTHERWISE STATED	
DATE 5.A.77	DATE 7.4.77	SCALE NOT TO BE SCALED		FINISH

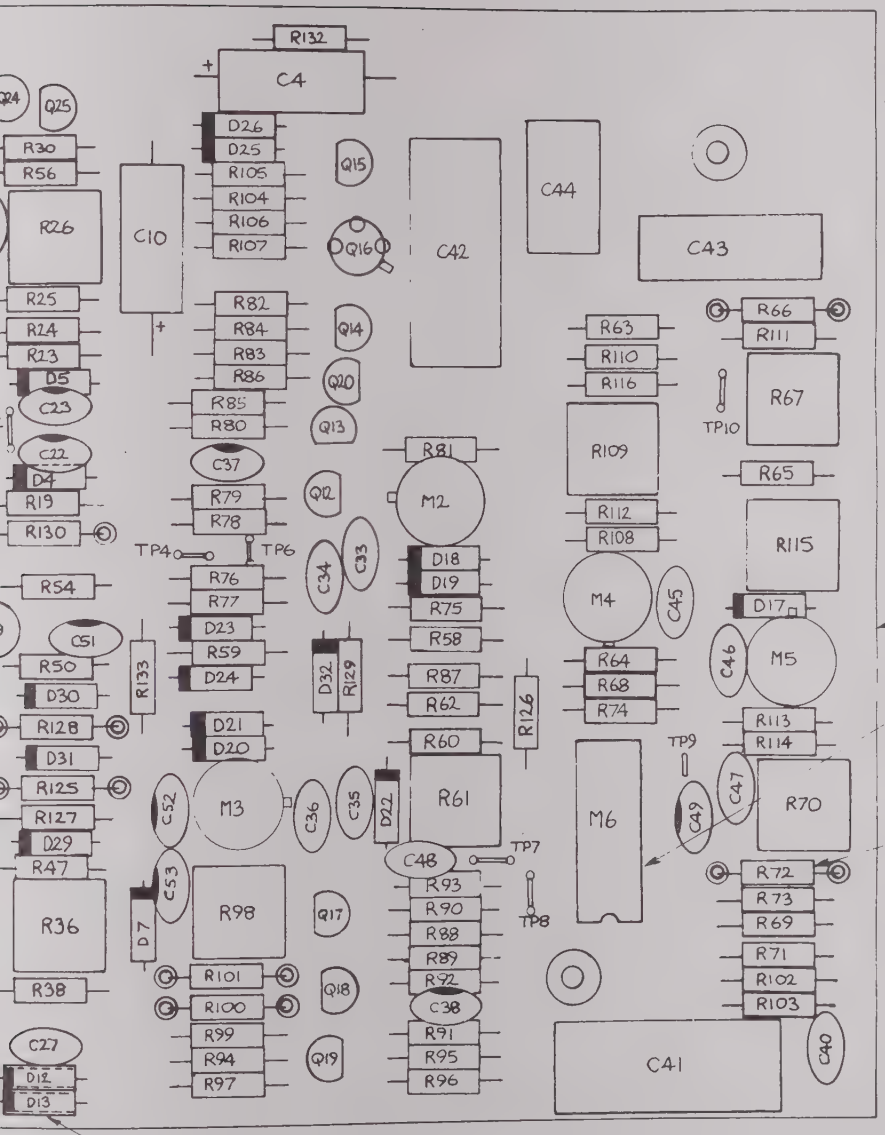
J.W 7162

4	5	6

ALL BURRS TO BE REMOVED

NOTES

1. FIT GUARD SHIELD (450012) WITH
   4 OFF M3 x 8 POZIPAN SCREW (611016)
   4 OFF SHAKE PROOF M3 (613005)
2. RELAY WIRING:
   ALL UNSTRIPPED WIRE LENGTHS ± 50mm (510999)
   ALL WIRE TERMINATIONS TO BE SLEEVED (590001)
3. C55, 56 & 59 SLEEVED WIRE 13·0mm LONG
   HOOK ENDS TO RETAIN SLEEVE (540002/590004)
4. THE FOLLOWING DIODES ARE TO BE SLEEVED WITH BLACK SLEEVES (590001).
   D10 & D11. D29 TO D32 (4 OFF).
5. FIT GROMMET (630018) OVER AC INPUT LEAD & INTO SLOT IN GUARD SHIELD.



PCB 410006-6A

FIT SOCKET STRIP
602004 16 OFF
SOLDER MG INTO SOCKETS AFTER TEST.

FIT ON ASSY
DO NOT SOLDER

4 OFF DIODES SLEEVED
BLACK SLEEVING 590011

FIT RELAYS K1, K2 WITH :-

RELAY BRACKET	(459112)	2 OFF
M3 x 8 POZIPAN	(611016)	2 OFF
M3 SHAKEPROOF	(613005)	2 OFF
M3 NUT	(615002)	2 OFF

ISS	CHANGES
19	REDRAWN TO INCLUDE ECO 423 5-4-77 PJH
20	ECO. 542 26.9.77 PT. LTS CHANGES. IL
21	ECO. 695. 30.5.78 PARTS LIST MODS. IL
22	ECO. 865. 1.6.78 SUPPY GUARD SHIELD 450152 DELETED IL.
23	E.C.O. 743 6-11-78 PARTS LIST MOD W.G.S
24	ECO. 836 PCB WAS 196.8 6-4-79 IL
25	E.C.O. 831 RESISTOR VALUE CHANGES TO PARTS LIST/CIRCUIT 4. MAY 79 W.G.S

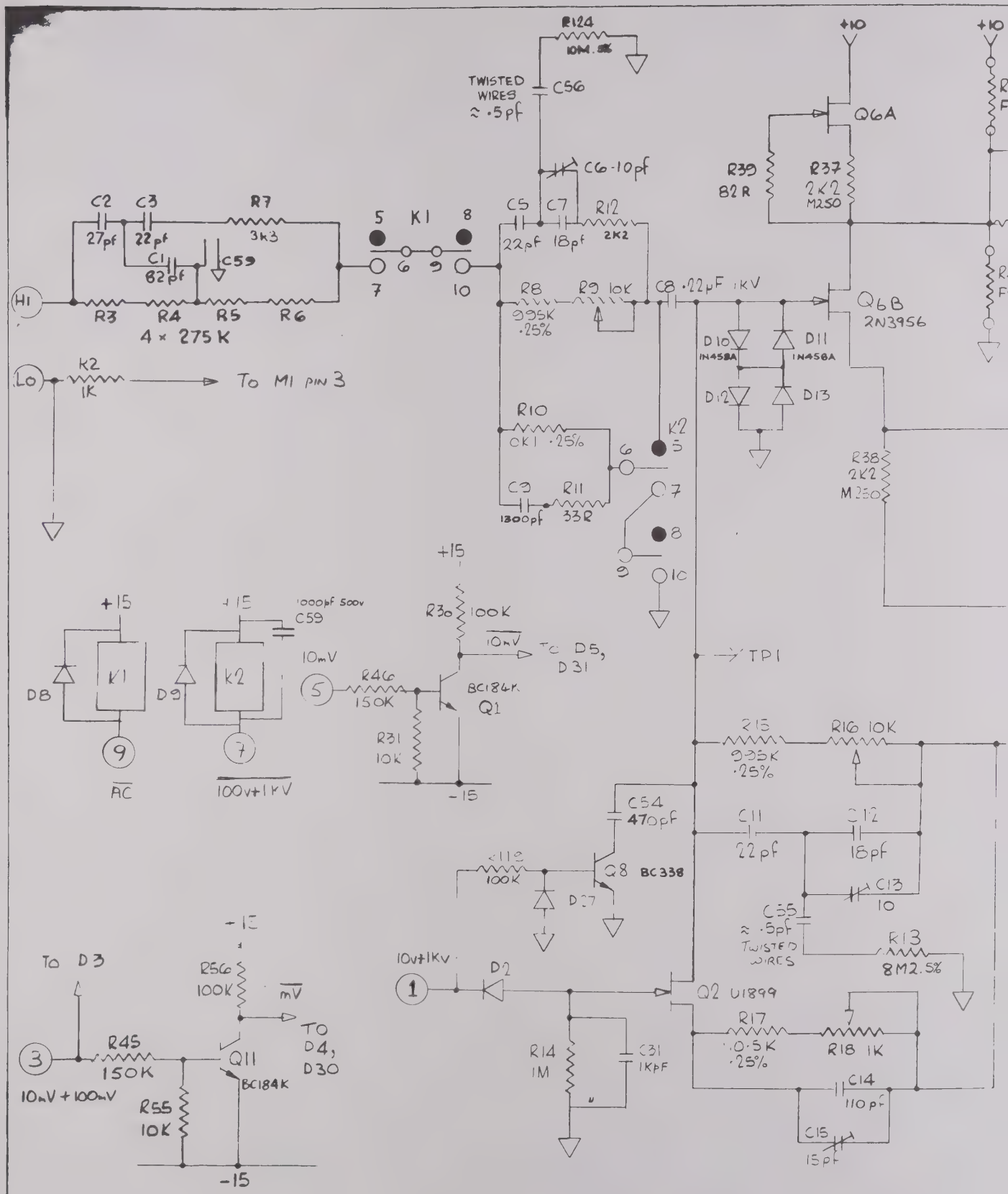
datron ELECTRONICS LTD. NORWICH.

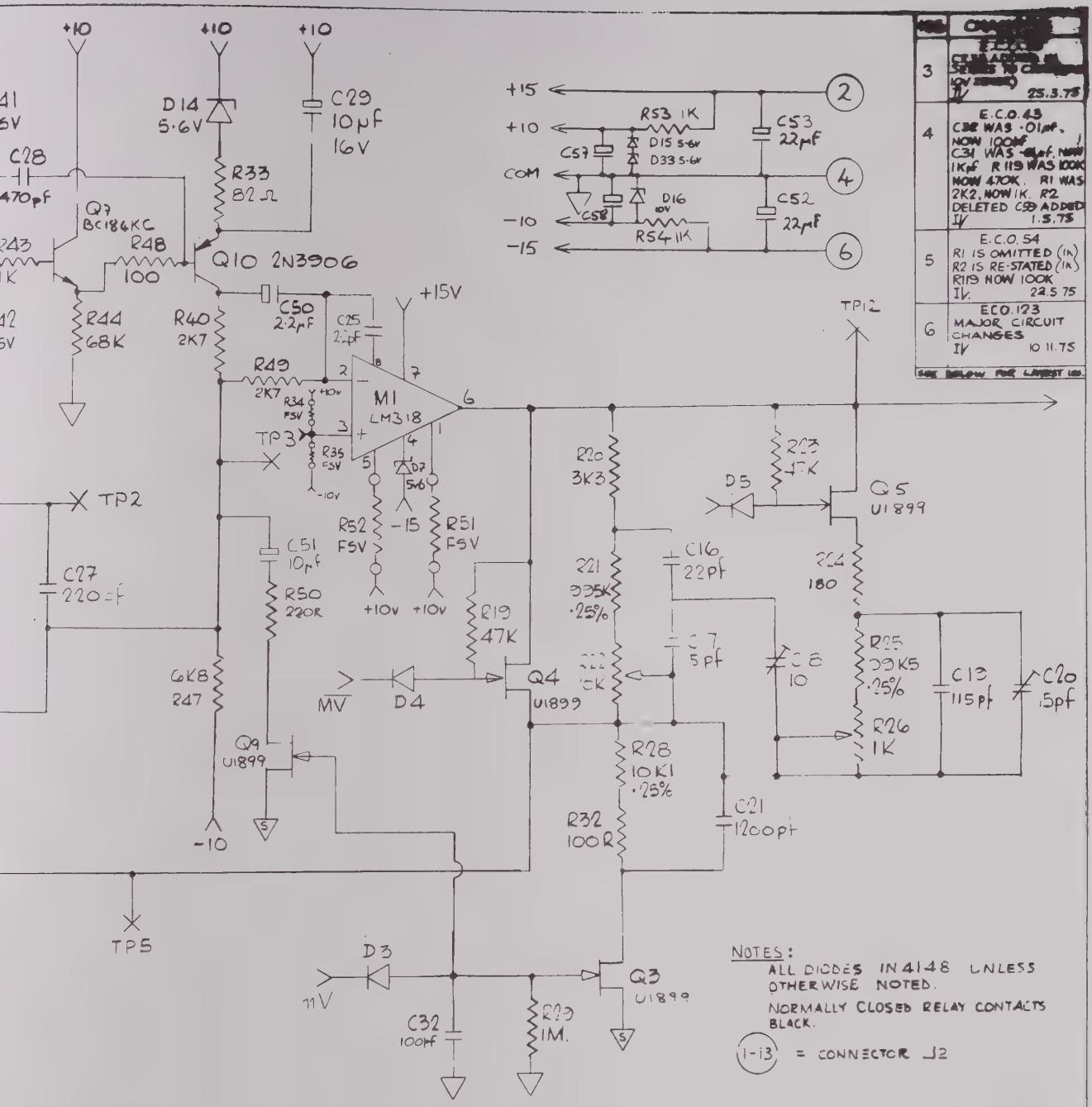
DRAWING SIZE A2

TITLE: AC OPTION 01 ASSEMBLY

DRAWING No. 400037

SHEET 1 OF 13


R124
10M. 5%
TWISTED WIRES ≈ .5pf
C56
C6 10pf
+10
Q6A
R39 82R
R37 2K2 M250
C2 27pf
C3 22pf
C1 82pf
C59
R7 3k3
R3 R4 R5 R6
4 × 275 K
HI
LO
K2 1K
To M1 pin 3
5 K1 8
6 9
7 10
C5 22pf
C7 18pf
R12 2K2
R8 995K .25%
R9 10K
C8 .22pF 1KV
Q6B 2N3956
D10 IN458A
D11 IN458A
D12
D13
R10 0K1 .25%
C9 1300pf
R11 33R
K2
R38 2K2 M250
+15
1000pf 500v C59
R30 100K
10mV
To D5, D31
D8
K1
D9
K2
R46 150K
BC184K Q1
R31 10K
-15
AC
100v+1KV
TP1
R15 995K .25%
R16 10K
C54 470pf
C11 22pf
C12 18pf
R118 100K
Q8 BC338
D7
C13 10
C55 ≈ .5pf TWISTED WIRES
R13 8M2.5%
-15
To D3
R56 100K
mV
TO D4, D30
R45 150K
Q11 BC184K
10mV + 100mV
R55 10K
-15
10v+1KV
D2
Q2 U1899
R14 1M
C31 1KpF
R17 .05K .25%
R18 1K
C14 110pf
C15 15pf



NOS.	
3	[illegible] 10V [illegible] IV 25.3.75
4	E.C.O.43 C32 WAS ·01mF, NOW 100nF C31 WAS 47µF, NOW 1KµF R119 WAS 100K NOW 470K. R1 WAS 2K2, NOW 1K. R2 DELETED C59 ADDED IV 1.5.75
5	E.C.O.54 R1 IS OMITTED (1K) R2 IS RE-STATED (1K) R119 NOW 100K IV. 22.5.75
6	ECO.123 MAJOR CIRCUIT CHANGES IV 10.11.75

SEE BELOW FOR LATEST ISS.

NOTES:
ALL DIODES IN4148 UNLESS OTHERWISE NOTED.
NORMALLY CLOSED RELAY CONTACTS BLACK.
(1-13) = CONNECTOR J2

REVISION	DATE
11	ECO 542 27.9.77
12	ECO.695 30.5.78
13	[illegible]

REVISION	DATE
3	ECO. 25 25/3/75
4	ECO 43 1.5.75
5	ECO 54 22.5.75
6	ECO 123 10/11/75
7	ECO 143 21/1/76
8	ECO 200 14-4-76
9	ECO 220 24.6.76
10	ECO 423 6.4.77 SHT 1&2

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R&D IKP

CHECK

PROD. A.D 2.2.77

NEXT DRG 400037

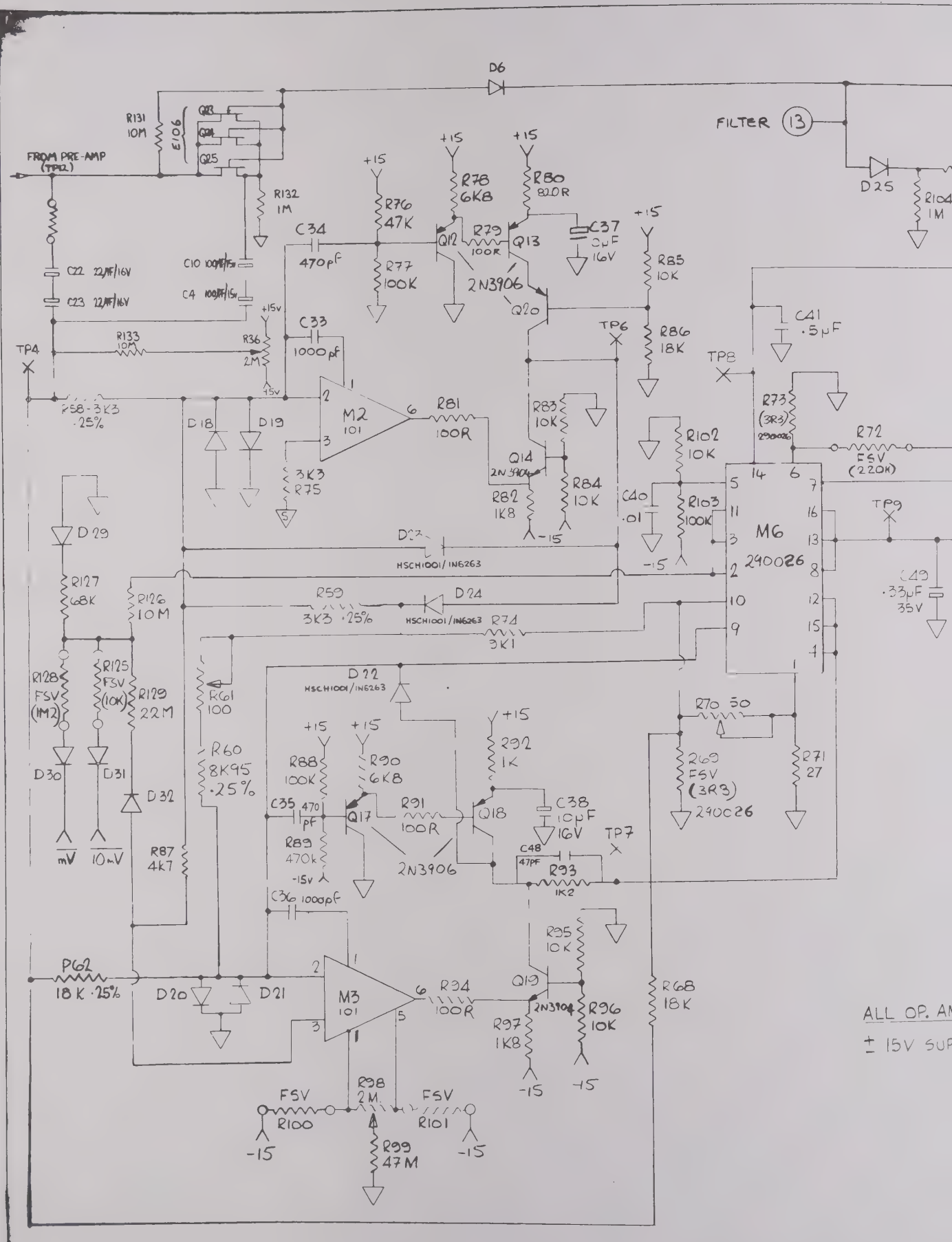
TITLE.

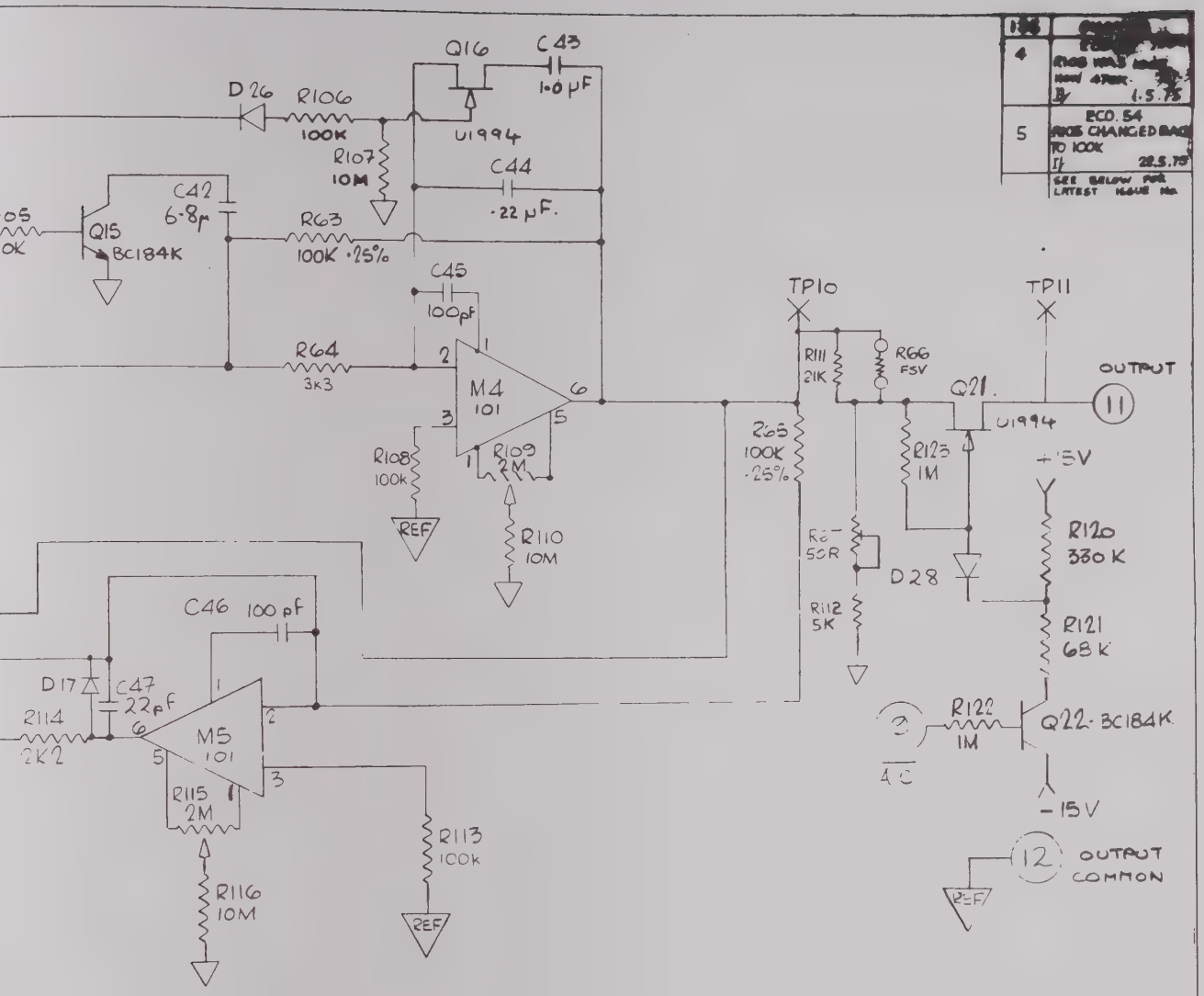
1041/1051

AC PREAMP

DRG Nº 430016.

SHEET 1 OF 2


D6
FILTER (13)
D25
R104 1M
FROM PRE-AMP (TP2)
R131 10M
E106
Q23
Q24
Q25
R132 1M
C22 22μF/16V
C23 22μF/16V
C10 100pF/15V
C4 100pF/15V
+15v
R133 10M
R36 2M
TP4
C34 470pF
R76 47K
R77 100K
+15
R78 6K8
R80 820R
Q12
R79 100R
Q13
2N3906
Q20
C37 2μF 16V
R85 10K
R86 18K
TP6
C33 1000pF
M2 101
R58 3K3 ·25%
D18
D19
3K3 R75
R81 100R
R83 10K
Q14 2N3904
R82 1K8
R84 10K
-15
TP8
C41 ·5μF
R73 (3R3) 290026
R72 FSV (220K)
R102 10K
C40 ·01
R103 100K
M6 290026
TP9
C49 ·33μF 35V
D23
HSCH1001/IN6263
D29
R127 68K
R126 10M
R59 3K3 ·25%
D24
HSCH1001/IN6263
R74 3K1
R128 FSV (1M2)
R125 FSV (10K)
R129 22M
D30
D31
D32
mV
10mV
R61 100
R60 8K95 ·25%
R87 4k7
D22
HSCH1001/IN6263
R88 100K
R90 6K8
C35 470 pF
Q17
R91 100R
Q18
R92 1K
C38 10pF 16V
TP7
R89 470k
C48 47PF
R93 1K2
2N3906
C36 1000pF
R70 50
R69 FSV (3R3) 290026
R71 27
P62 18K ·25%
D20
D21
M3 101
R94 100R
Q19
2N3904
R95 10K
R96 10K
R97 1K8
R68 18K
R98 2M
R99 47M
FSV R100
FSV R101
ALL OP. AM
± 15V SUP



		4		1.5.75
		5	ECO. 54 RVDS CHANGED BACK TO 100K	22.5.75
			SEE BELOW FOR LATEST ISSUE No.	

	10	SEE SHT1	2	27.10.74
	11	27.9.77 ECO 542	3	—
MD	12	30.5.78 ECO.695	4	1.5.75 ECO.43
MD	13	8.5.79 831	5	22.5.75 ECO. 54
			6	10.11.75 ECO 123
			7	21.1.76 ECO.143
			8	14.4.76 ECO 200
			9	24.6.76 ECO 220

REVISION | DATE

datron ELECTRONICS LTD.

DRD

CHECK

PROD L. A.D. 2.2.77

NEXT DRG 400037

TITLE.

AC RMS

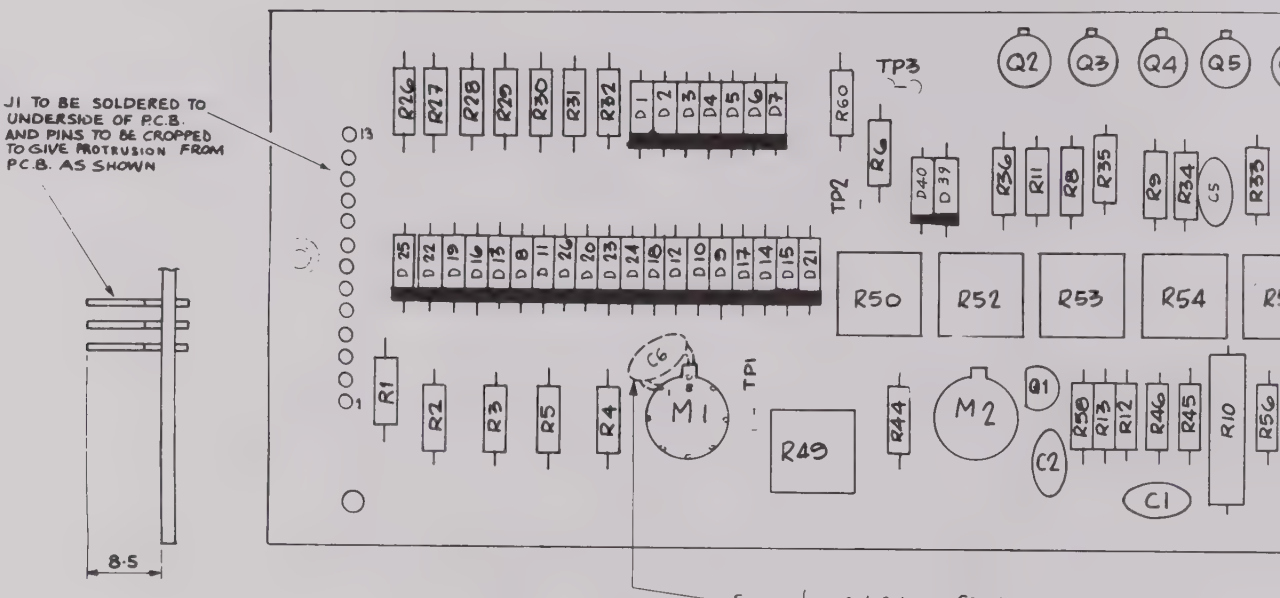
1041/1051

DRAWING No

430016

SHEET 2

OF 2

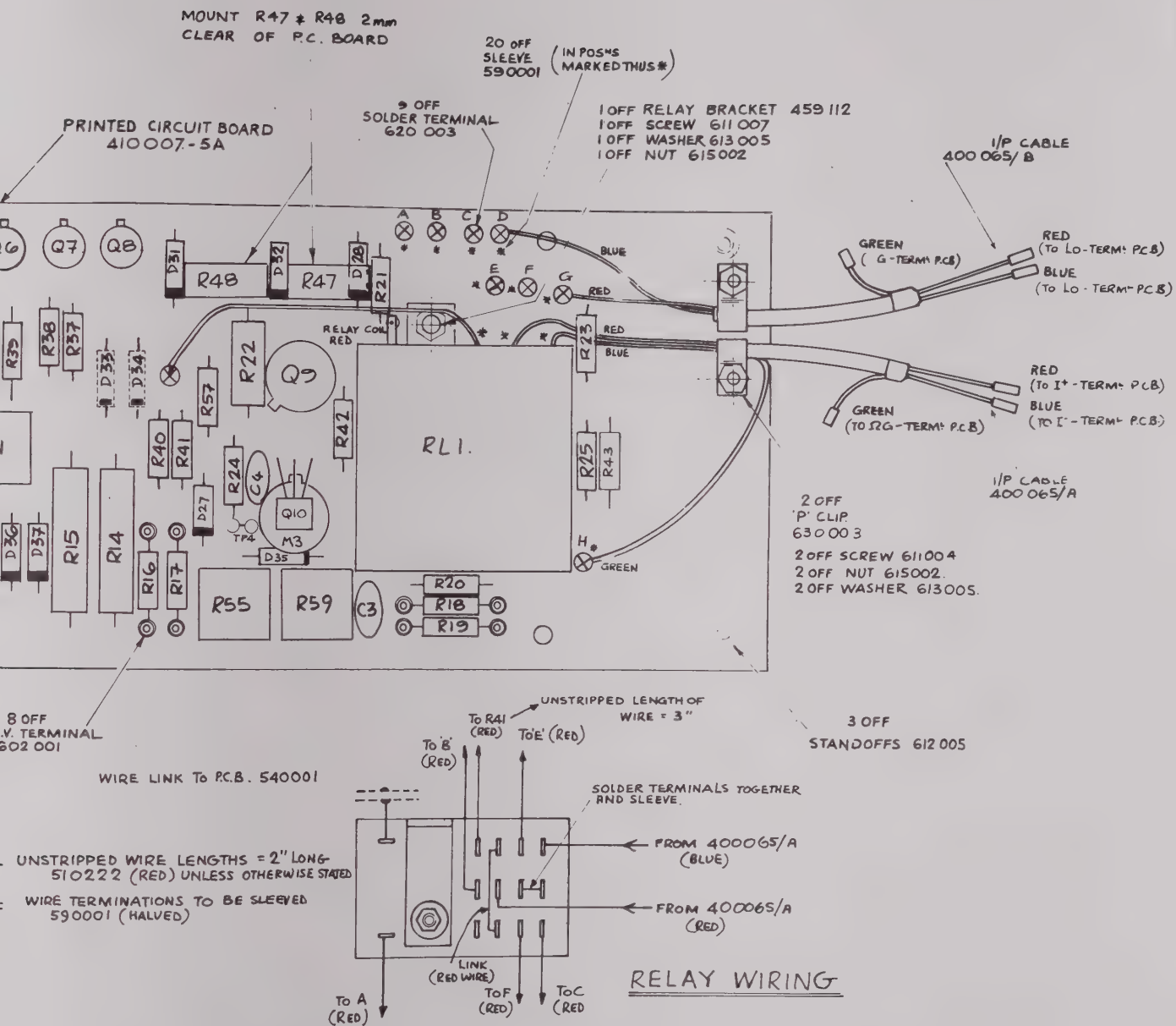

J1 TO BE SOLDERED TO UNDERSIDE OF P.C.B. AND PINS TO BE CROPPED TO GIVE PROTRUSION FROM P.C.B. AS SHOWN
8·5
13
1
R26 R27 R28 R29 R30 R31 R32
D1 D2 D3 D4 D5 D6 D7
R60
TP3
TP2
R6
D40 D39
Q2 Q3 Q4 Q5
R36 R11 R8 R35 R9 R34 C5 R33
D25 D22 D19 D16 D13 D8 D11 D26 D20 D23 D24 D18 D12 D10 D9 D17 D14 D15 D21
R50 R52 R53 R54
R1 R2 R3 R5 R4
C6
M1
TP1
R49
R44
M2
Q1
C2
R50 R13 R12 R46 R45 R10 R56
C1
SLEEVE LEADS & SOLDER C6 ACROSS PINS 1 & 8 OF M1 ON UNDERSIDE OF PCB.

NOTES:

1. TEST POINT LOOPS (T.P's) MADE FROM 24 SWG. B.T.C. WIRE (540001), CUT AS REQ'D.
2. Q10 AND M3 STUCK TOGETHER WITH CYANOCRYLATE. BY CHECKOUT
3. FIT GUARD SHIELD (450011) WITH 3 OFF SCREW POSIPAN M3 x 6 (611004) AND 3 OFF M3 SHAKPROOF (613005)
4. SLEEVE D33, D34 WITH BLACK SLEEVING (590011)
5. THE FOLLOWING DIODES ARE TO BE SLEEVED WITH BLACK SLEEVES 580001 D1 TO D7. D27. D35 & D40. (10 OFF) ½ SLEEVE 10"/m PER DIODE.

PIN REF.	LEAD DESTINATION	WIRE COLOUR	
A	RELAY COIL. PIN 1	RED	
B (I+)	" COMMON. " 12	RED	
C (I-)	" N/O " 10	RED	
D	Lo (TERM. P.C.B)	BLUE	
E	RELAY N/C. PIN 14	RED	
F	" N/C " 8	RED	
G	Lo (TERM. P.C.B.)	RED	
H	ΩG (" ")	GREEN	
R41	RELAY N/C PIN 11	RED	

L.A.D.



RELAY WIRING

REVISION	DATE	REVISION	DATE
11	9-9-76 ECO 274		19/5/75
12	31.3.77 ECO. 425	4	10/9/75 ECO. 101
13	24.9.77 ECO 520	5	3/10/75 ECO. 113
14	14-3-78 ECO 602	6	2/1/76 ECO. 132
15	15.3.78 ECO. 658	7	27.2.76 ECO. 164
16	30.5.78 ECO. 696	8	3.3.76. ECO. 181
17	28 NOV 78 E.C.O. 750.	9	6.5.76. ECO 195
18	6-4-79 ECO. 844	10	6.5.76. ECO 206

datron ELECTRONICS LTD

R&D

CHECK

PROD A.A.D 2.2.77

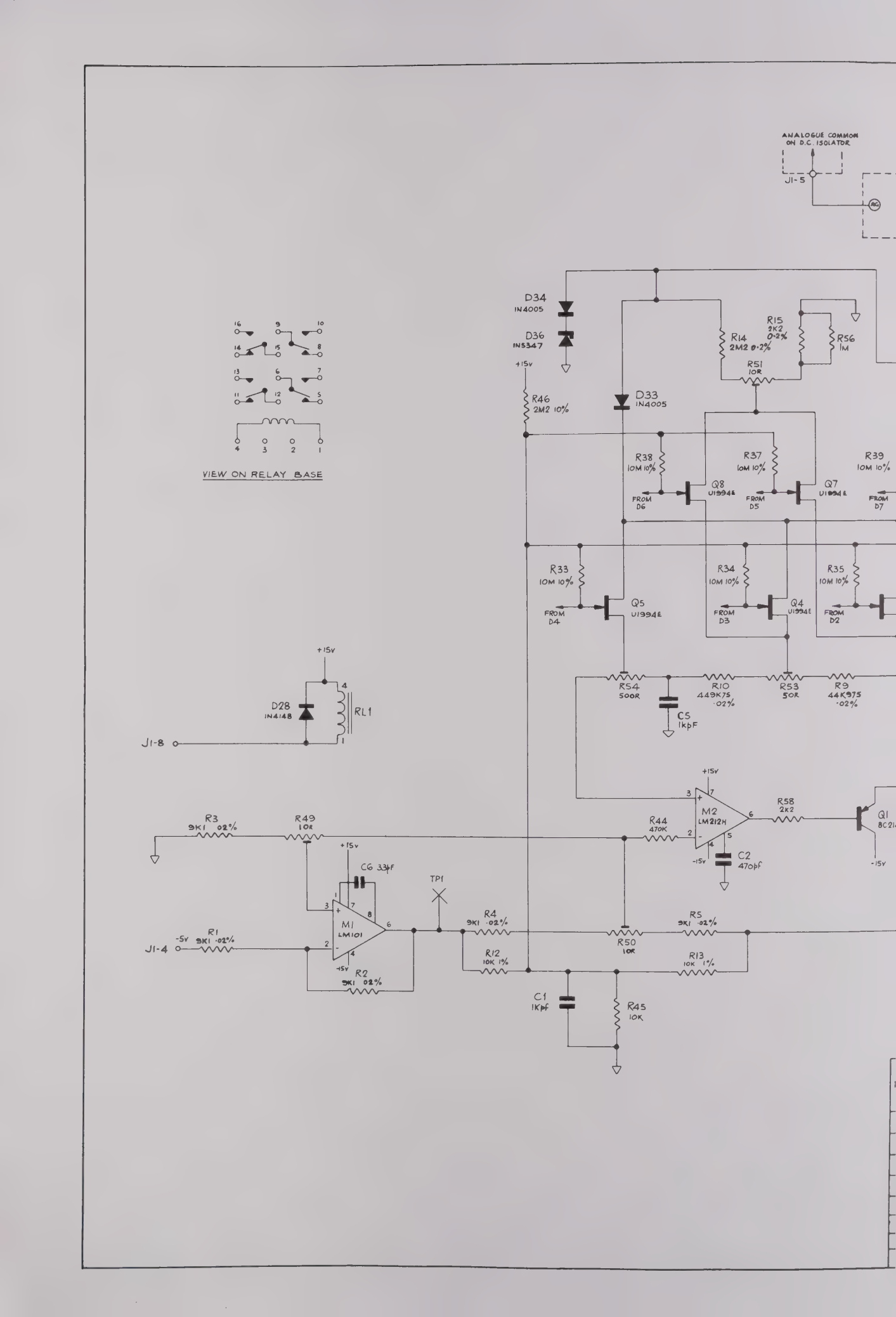
NEXT DRG.

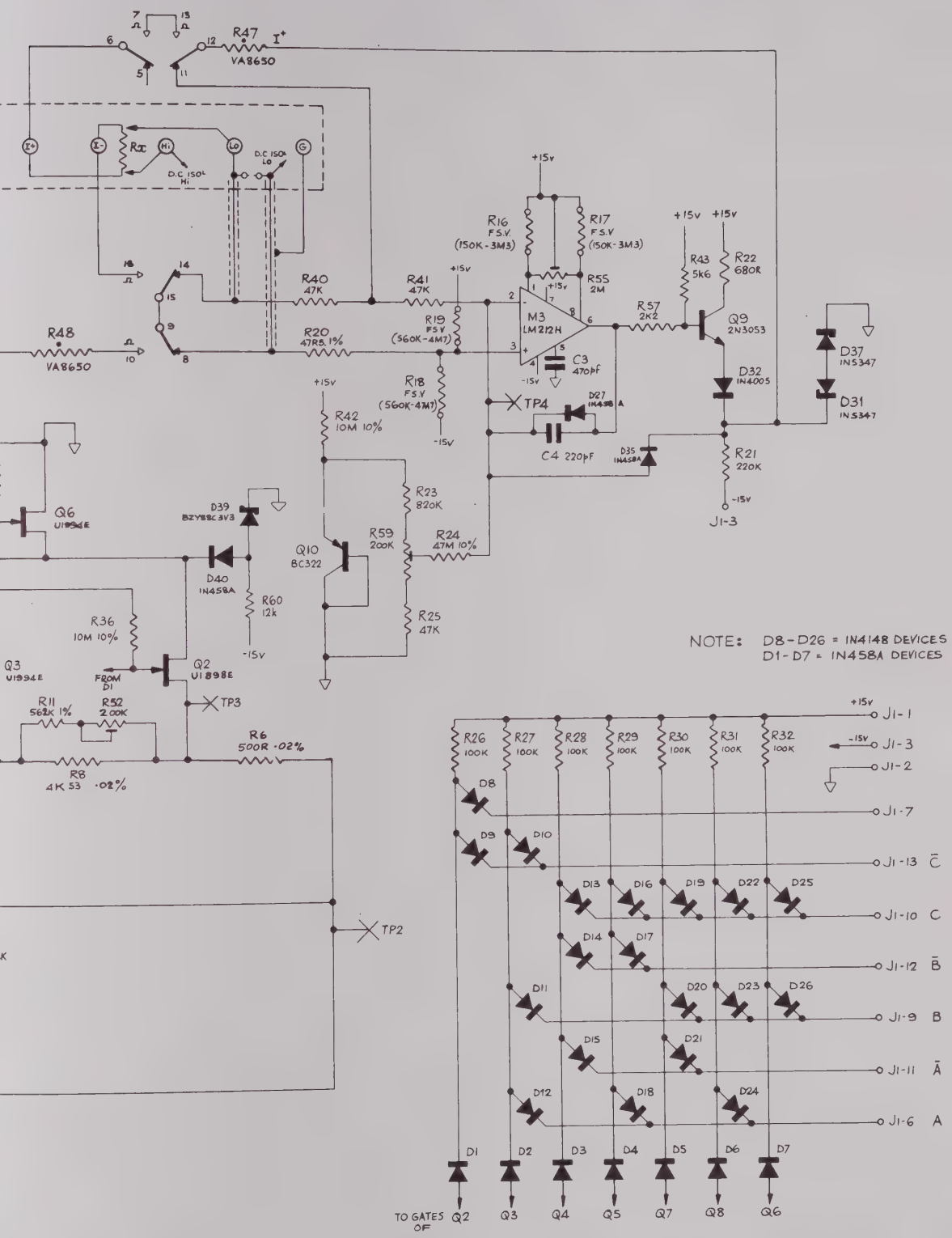
TITLE

1051 Ω CARD: PCB ASSEMBLY

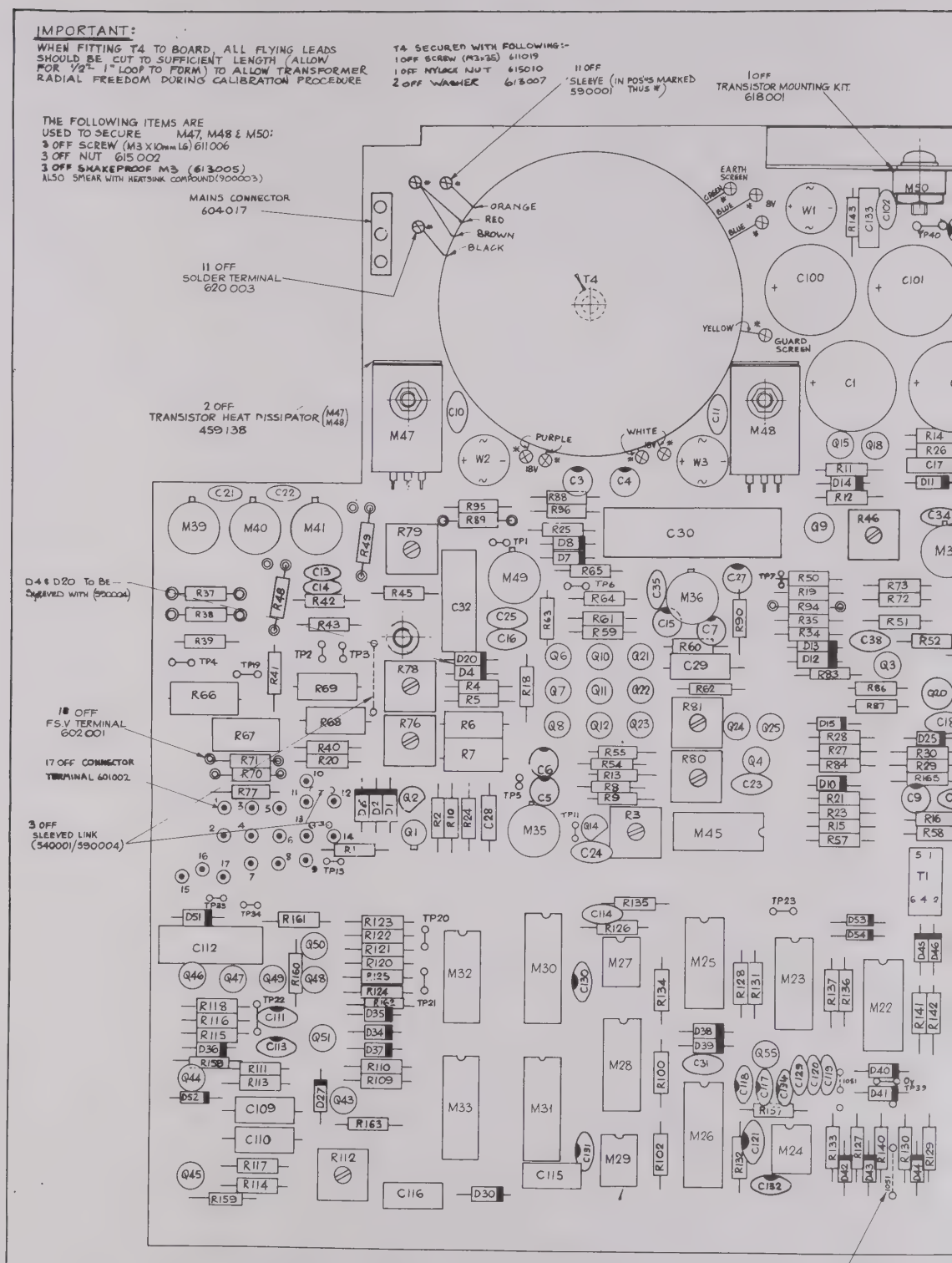
DRAWING Nº 400089

SHEET 1 OF 5


ANALOGUE COMMON ON D.C. ISOLATOR
J1-5
D34 IN4005
D36 IN5347
+15V
R46 2M2 10%
D33 IN4005
R14 2M2 0·2%
R15 2K2 0·2%
R56 1M
R51 10R
R38 10M 10%
R37 10M 10%
R39 10M 10%
Q8 U1994E
Q7 U1994E
FROM D6
FROM D5
FROM D7
R33 10M 10%
R34 10M 10%
R35 10M 10%
Q5 U1994E
Q4 U1994E
FROM D4
FROM D3
FROM D2
VIEW ON RELAY BASE
+15V
D28 IN4148
RL1
J1-8
R54 500R
C5 1kpF
R10 449K75 ·02%
R53 50R
R9 44K975 ·02%
+15V
M2 LM212H
R58 2K2
Q1 BC212
R3 9K1 02%
R49 10R
R44 470K
C2 470pF
-15V
+15V
C6 33pF
TP1
M1 LM101
R4 9K1 ·02%
R5 9K1 ·02%
R50 10R
J1-4
-5V
R1 9K1 ·02%
R12 10K 1%
R13 10K 1%
+15V
R2 9K1 02%
C1 1kpf
R45 10K



REVISION	DATE	REVISION	DATE	datron ELECTRONICS LTD	
5	6.5.76 ECO 195		23.5.75	R&D I V	TITLE: 1051 Ω CARD SCHEMATIC
6	21.9.77 ECO. 520				
7	14-3-78 ECO 602	2	10/9/75 E.C.O.101	CHECK	
8	30.5.78 ECO. 696				
9	28 Nov 78. E.C.O. 730/763	3	27.2.76 ECO. 168	PROD. A.A.D. 2.2.77	DRAWING NO. 430027
10	6-4-79 ECO.844				SHEET 1 OF 1
		4	2.3.76 ECO. 181	NEXT DRG	



PIN Nº	PIN FUNCTION	LEAD COLOUR
1	ANAL. COMM.	GREEN
2	ANAL COMM	GREEN R
3	-15v	BLUE
4	-15v	BLUE R
5	+15v	RED
6	+15v	RED R
7	GUARD	YELLOW
8	SIG COMM	BLACK
9	SIG. INPUT	ORANGE
10	-5v REF (TO OHMS)	PURPLE
11	-5v REF-SENSE OUT	BROWN R
12	EXT REF " IN	WHITE R
13	-5v REF DRIVE OUT	WHITE/RED R
14	EXT REF. DRIVE	ORANGE/BLK R
15	RATIO LAMP DRIVE	GREY R
16	+5v POWER	RED/BLK R
17	DIGITAL COMMON	PINK R

← R = RATIO ONLY

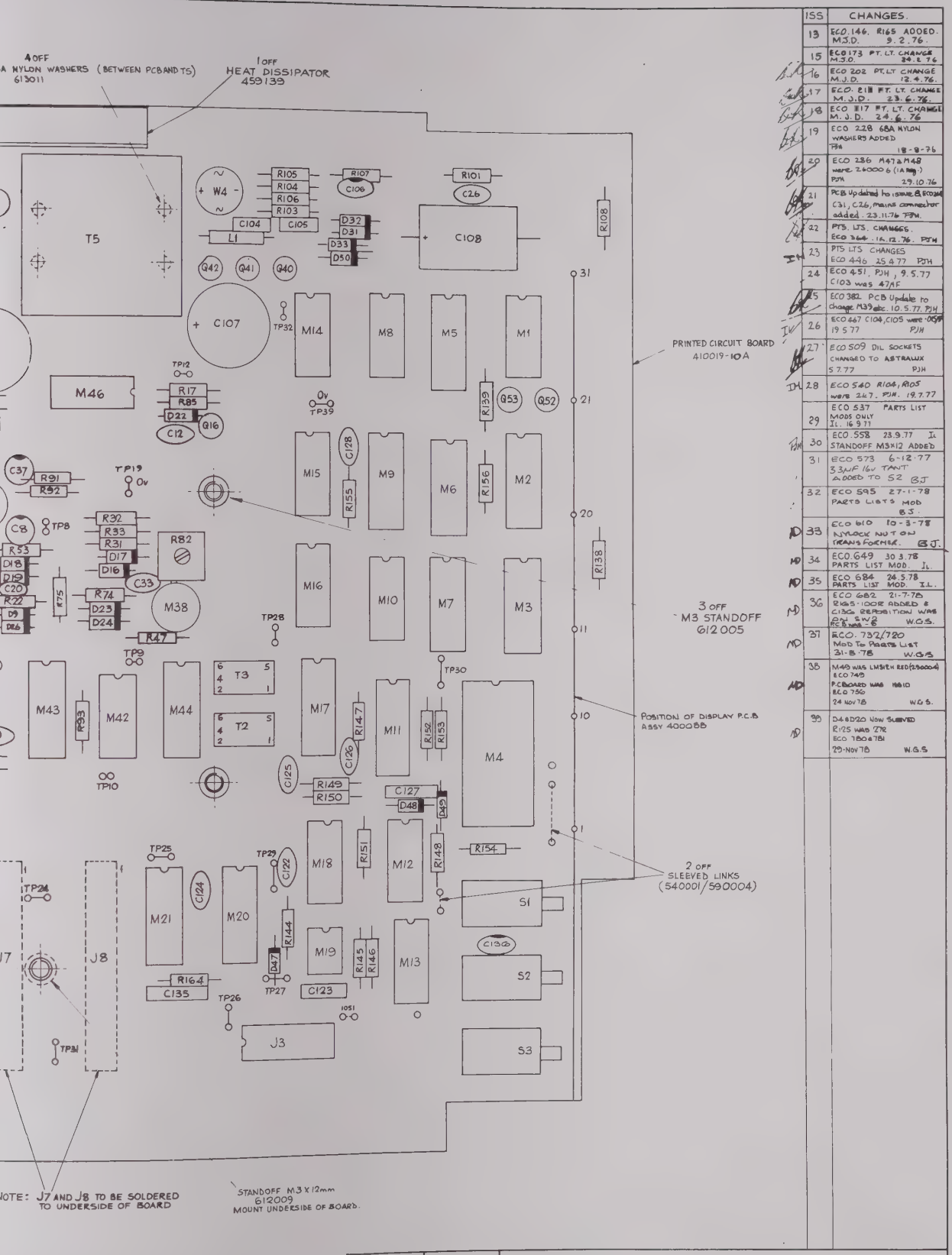
M19, M24, M27 & M29 MOUNTED ON SOCKETS PART No 605059

NOTE

OTHER ITEMS REQ'D TO ASSEMBL
1 16-WAY D.I.L. SOCKET 605
2 14-WAY D.I.L. SOCKET 605
3 24 WAY D.I.L. SOCKET 605

4. TEST POINT LOOPS (TP1 etc) 24 SWG B.T.C WIRE. (5400

5. UPPER GUARD SHIELD
LOWER GUARD SHIELD
WITH SCREW M3 X 10
AND SHAKEPROOF M3



ISS	CHANGES.
13	ECO.146. R165 ADDED. M.J.D. 9.2.76.
15	ECO 173 PT. LT. CHANGE M.J.D. 24.2.76
16	ECO 202 PT. LT CHANGE M.J.D. 12.4.76.
17	ECO. 218 PT. LT. CHANGE M.J.D. 23.6.76.
18	ECO 217 PT. LT. CHANGE M. J. D. 24.6.76
19	ECO 228 68A NYLON WASHERS ADDED PJH 18-8-76
20	ECO 236 M47 & M48 were 26000 6 (1A Neg.) PJH 29.10.76
21	PCB Updated to issue 8 ECO 246 C31, C26, mains connector added. 23.11.76 PJH.
22	PTS. LTS. CHANGES. ECO 366. 16.12.76. PJH
23	PTS LTS CHANGES ECO 446 25.4.77 PJH
24	ECO 451. PJH, 9.5.77 C103 was 47AF
25	ECO 382. PCB Update to change M39 etc. 10.5.77. PJH
26	ECO 447 C104, C105 were .05µF 19.5.77 PJH
27	ECO 509 DIL SOCKETS CHANGED TO ASTRALUX 5.7.77 PJH
28	ECO 540 R104, R105 were 24?. PJH. 19.7.77
29	ECO 537 PARTS LIST MODS ONLY IL. 16.9.77
30	ECO 558 23.9.77 IL STANDOFF M3x12 ADDED
31	ECO 573 6-12-77 3.3µF 16v TANT ADDED TO S2 BJ
32	ECO 595 27-1-78 PARTS LISTS MOD BJ.
33	ECO 610 10-3-78 NYLOCK NUT ON TRANSFORMER. BJ.
34	ECO.649 30.3.78 PARTS LIST MOD. IL.
35	ECO 684 24.5.78 PARTS LIST MOD. IL.
36	ECO 682 21-7-78 R165-100R ADDED & C136 REPOSITION WAS R24 SW6 PCB No. 6 W.G.S.
37	ECO. 732/720 Mod To Parts List 31-8-78 W.G.S
38	M48 WAS LM317H RED(230004) ECO 749 P.C.BOARD WAS 19810 ECO 750 24 NOV 78 W.G.S.
39	D4 & D20 Now SLEEVED R125 WAS 27R ECO 780 & 781 29-NOV 78 W.G.S

NOTE: J7 AND J8 TO BE SOLDERED TO UNDERSIDE OF BOARD

STANDOFF M3 X 12mm
612009
MOUNT UNDERSIDE OF BOARD.

E P.C.B:
238 16 OFF
237 17 OFF
012 1 OFF

MADE FROM
01) CUT AS REQD.

30039 AND
30040 SECURED
611006) 6 OFF
613005) 6 OFF

6. THE FOLLOWING DIODES ARE TO BE SLEEVED WITH BLACK SLEEVES (590004)
D1 & D2. D6 TO D10. D14. D18 & D19. (10 OFF)

REVISION	DATE
	8/5/75
2 ECO. 58	30/5/75
3 ECO. 72	5/8/75
8 ECO 93	9/9/75
9 ECO 111	3/10/75
10 ECO 20	23/10/75
11 ECO 137	8/1/76
12 ECO 141	26/1/76

datron ELECTRONICS LTD

R&D.

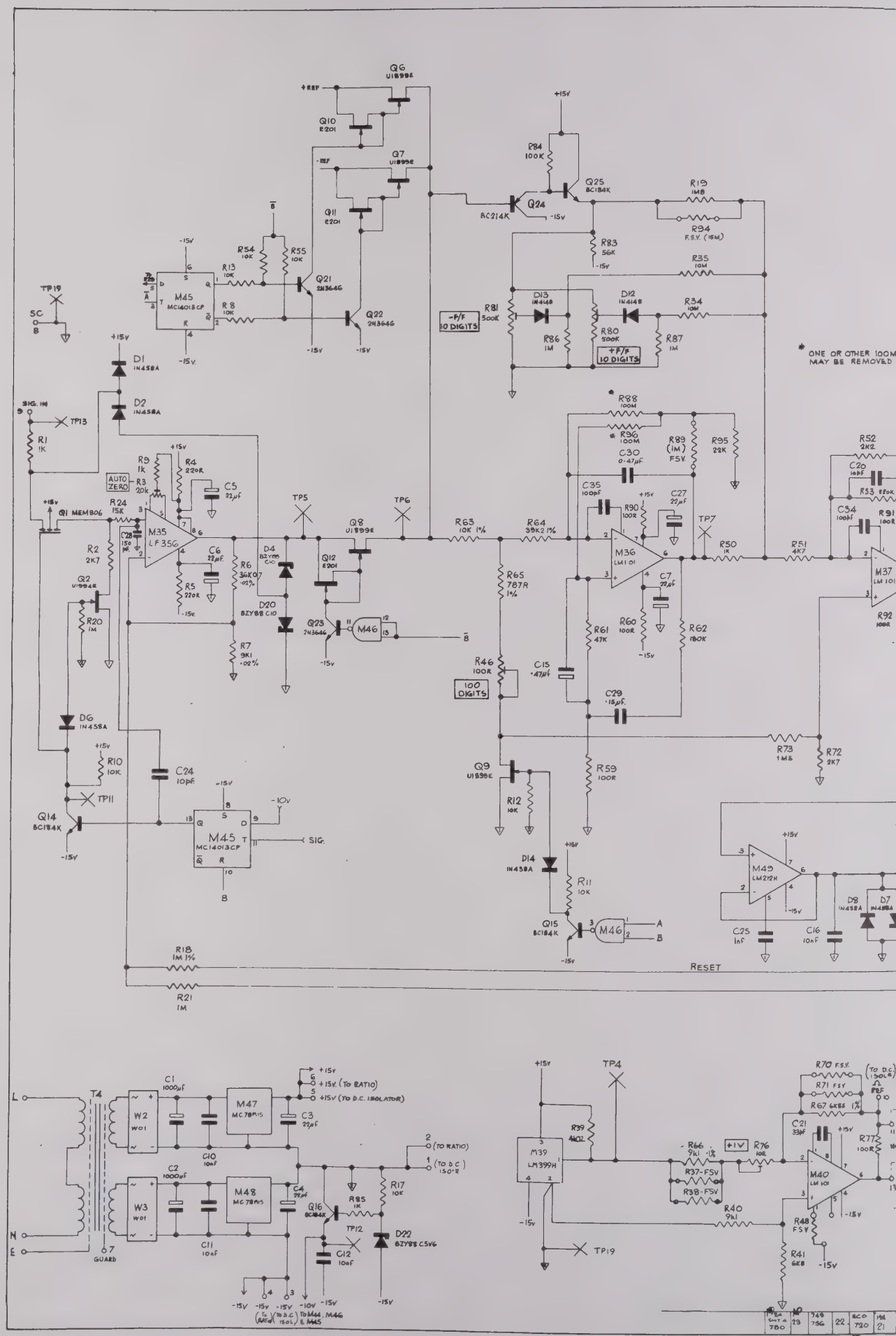
CHECK

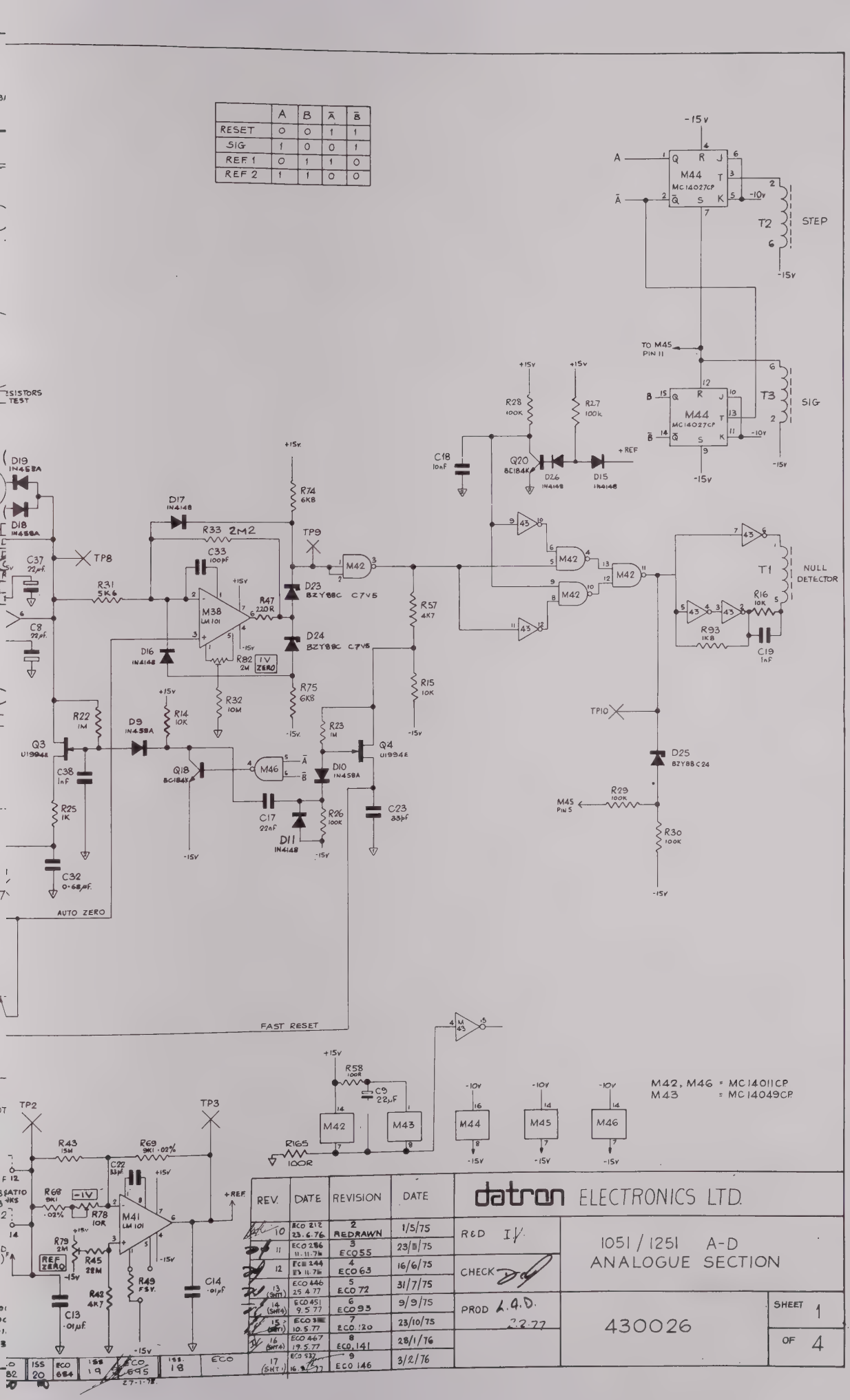
PROD

1051 A-D
P.C.B. ASSEMBLY

400094

SHEET 1
OF 22


Q6 U1899E
+REF
Q10 E201
Q7 U1899E
-REF
Q11 E201
B
-15V
R54 10K
R55 10K
R13 10K
R8 10K
M45 MC14013CP
Q21 2N3646
Q22 2N3646
TP19
SC
B
+15V
D1 IN458A
D2 IN458A
SIG. IN
TP13
R1 1K
AUTO ZERO
R9 1k
R3 20k
R4 220R
C5 22µF
Q1 MEM806
R24 15K
C28 150 pF
M35 LF356
R2 2K7
C6 22µF
R5 220R
Q2 U1994E
R20 1M
R6 3K07 .02%
D4 BZY88 C10
D20 BZY88 C10
R7 9K1 .02%
TP5
TP6
Q8 U1899E
Q12 E201
Q23 2N3646
M46
R63 10K 1%
R64 39K2 1%
R65 787R 1%
R46 100R
100 OKGITS
C15 .47µF
C29 .15µF
D6 IN458A
R10 10K
C24 10pF
TP11
Q14 BC184K
M45 MC14013CP
-10V
SIG.
R18 1M 1%
R21 1M
RESET
Q24 BC214K
Q25 BC184K
R84 100K
R19 1MB
R94 F.S.V. (1SM)
R83 56K
R35 10M
D13 IN4148
D12 IN4148
R34 10M
R81 500K
-F/F 10 DIGITS
R86 1M
R80 500K
+F/F 10 DIGITS
R87 1M
* ONE OR OTHER 100M MAY BE REMOVED
R88 100M
R96 100M
R89 (1M) F.S.V.
R95 22K
C30 0.47µF
C35 100pF
R90 100R
C27 22µF
TP7
M36 LM101
R50 1K
R51 4K7
R52 2K2
C20 100pF
R33 820K
C34 100pF
R91 100R
M37 LM101
R92 100R
R61 47K
R60 100R
C7 22µF
R62 180K
R59 100R
R73 1MB
R72 2K7
Q9 U1899E
R12 10K
D14 IN458A
R11 10K
Q15 BC184K
M46
A
B
M49 LM212H
C25 1nF
C16 10nF
D8 IN458A
D7 IN458A
T4
L
N
E
GUARD
C1 1000µF
C2 1000µF
W2 W01
W3 W01
M47 MC78M15
M48 MC78M15
C10 10nF
C11 10nF
C3 22µF
C4 22µF
+15V
+15V (To RATIO)
+15V (TO D.C. ISOLATOR)
2 (TO RATIO)
1 (TO D.C. ISOLATOR)
R17 10K
R85 1K
Q16 BC184K
TP12
C12 10nF
D22 BZY88 C5V6
-15V
-10V
To RATIO
TO D.C. ISOL'R
TO M44, M46 & M45
TP4
M39 LM399H
R39 4K02
R66 9k1 1%
R37-F.S.V.
R38-F.S.V.
+1V
R76 10R
R40 9k1
TP19
R70 F.S.V.
(TO D.C. ISOL'R)
R71 F.S.V.
R67 6K65 1%
C21 33pF
R77 100R
M40 LM101
R48 F.S.V.
R41 6K8
-15V


A B Ā B̄
RESET 0 0 1 1
SIG 1 0 0 1
REF 1 0 1 1 0
REF 2 1 1 0 0
M44 MC14027CP
T2 STEP
T3 SIG
TO M45 PIN 11
+REF
M42
M43
M46
M38 LM101
M41 LM101
T1 NULL DETECTOR
AUTO ZERO
FAST RESET
M42, M46 = MC14011CP
M43 = MC14049CP
datron ELECTRONICS LTD.
1051 / 1251 A-D
ANALOGUE SECTION
430026
SHEET 1
OF 4

J3		J7	J8
1	TRANSFER	-	-
2	$\overline{RANGING}$	-	-
3	$\overline{DP4}$	-	11
4	$\overline{DP3}$	-	12
5	$\overline{DP2}$	-	13
6	$\overline{DP1}$	-	14
7	$\overline{AUTO}$	5	-
8	$\overline{F1}$	-	15
9	$\overline{DC}$	7	-
10	$\overline{AC}$	2	-
11	$\overline{FILTER}$	13	-
12	$\overline{\Omega}$	-	16
13	UP	-	-
14	DOWN	-	-
15	+5V	10	-
16	0V	9	-

J7		J3
1	O_A	-
2	$\overline{AC}$	10
3	$\overline{SIG}$	-
4	DELAY	-
5	$\overline{AUTO}$	7
6	- VE	-
7	$\overline{DC}$	9
8	+ VE	-
9	0V	16
10	+5V	15
11	$\overline{HOLD}$	-
12	$\overline{COMMAND}$	-
13	$\overline{FILTER}$	11
14	$\overline{FP\ OVERRIDE}$	-
15	$\overline{PRINT\ INHIBIT}$	-
16	DATA VALID	-

J8		J3
1	OVERRANGE	-
2	OVERLOAD	-
3	B	-
4	A	-
5	D	-
6	C	-
7	O_C	-
8	O_B	-
9	O_D	-
10	O_C	-
11	$\overline{DP4}$	3
12	$\overline{DP3}$	4
13	$\overline{DP2}$	5
14	$\overline{DP1}$	6
15	$\overline{F1}$	8
16	$\overline{\Omega}$	12

* R135 IS REPLACED BY CIRCUIT SHOWN THUS, ON 1251 ONLY :

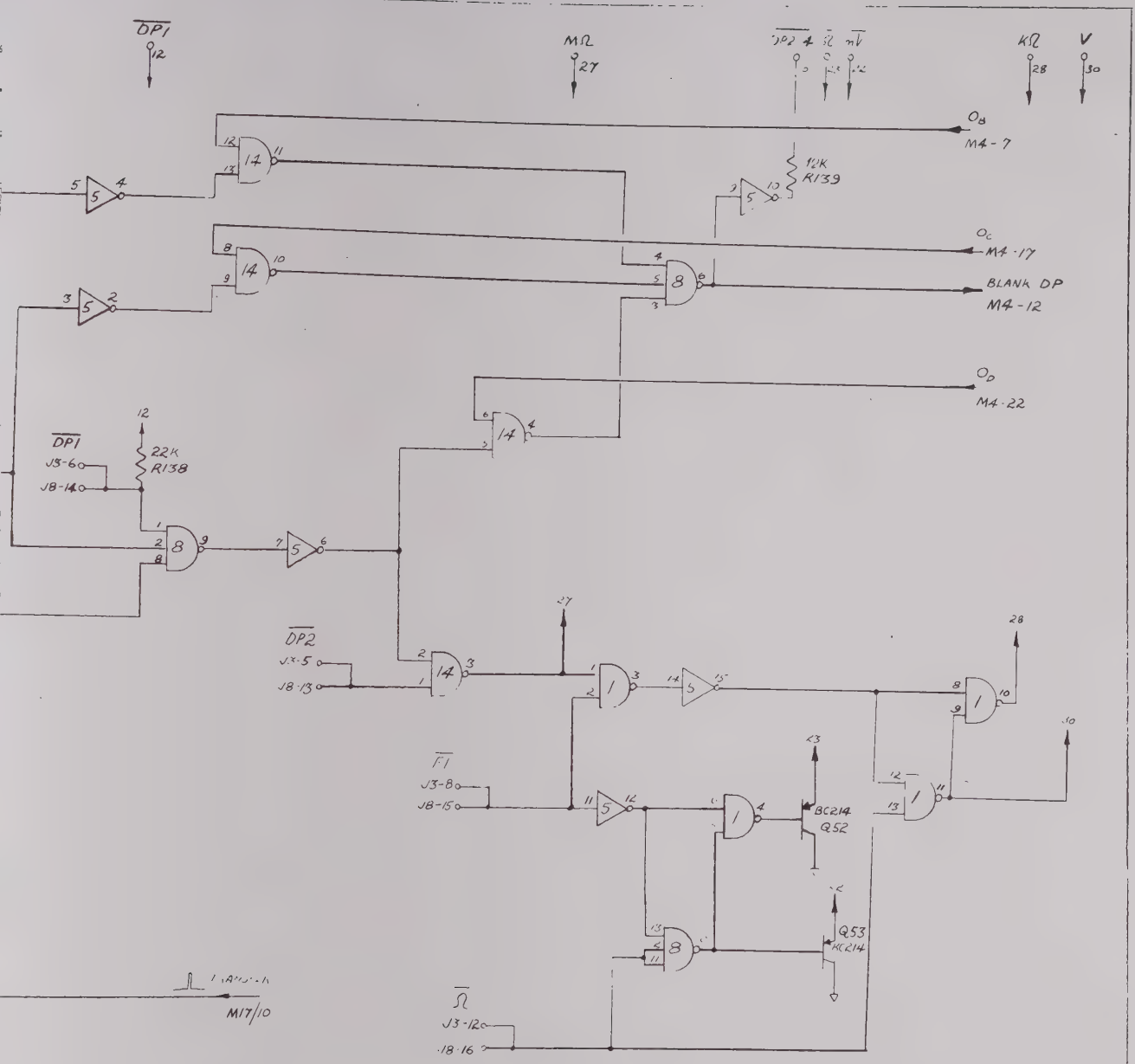
ASSY 400238
R2 82k
R1 2M

$\overline{DP4}$ J3-3 — J8-11
$\overline{DP3}$ J3-4 — J8-12

$\overline{COMMAND}$ J7 12
$\overline{HOLD}$ J7-11
$\overline{PRINT\ INHIBIT}$ J7-15
$\overline{RANGING}$ J3-2
FRONT PANEL OVERRIDE J7-14
1051 $\overline{AUTO}$ J3-7 / J7-5
$\overline{AC}$ J3-10 / J7-2
$\overline{DELAY}$ J7-4
1051 $\overline{FILTER}$ J3-11 / J7-13

R140 100K
R127 100K
R129 100K
R130 100K
R131 100K
R134 100K
R135 82K
R128 3K3
R157 47K
R132 47K
R133 56K
C129 1nF
C131 1nF
C130 2.2µ
C136 3.3µF
C134 2.2µf
C117 .33µf
C118 6.8µf
C121 .1µf
C132 47µ
C119 10nF
C120 10nF
R137 10K
D42 IN4148
D43 IN4148
D41 IN4148
D44 IN4148
D40 IN4148
D38 HG5009
D39 HG5009
Q55 BC184K
S1
S2
S3
M27
M24
DATA VALID

N.B SWITCH S3 NOT FITTED TO 1251 ASSYS



ISSUE	DATE	REVISION	DATE
15	(SHT 1)		19-2 75
16	(SHT 1)		
17	(SHT 1)		
18	(SHT 1)	1 ECO. 72	23.7 75
19	(SHT 1)		
20	(SHT 1)		
21	(SHT 1)	2 ECO 244	23 11 76
22	(SHT 1)		
23	(SHT 1)		
24	SHTS 1&2		
		13	(SHT 1)
		14	(SHT 1)

datron ELECTRONICS LTD

R&D

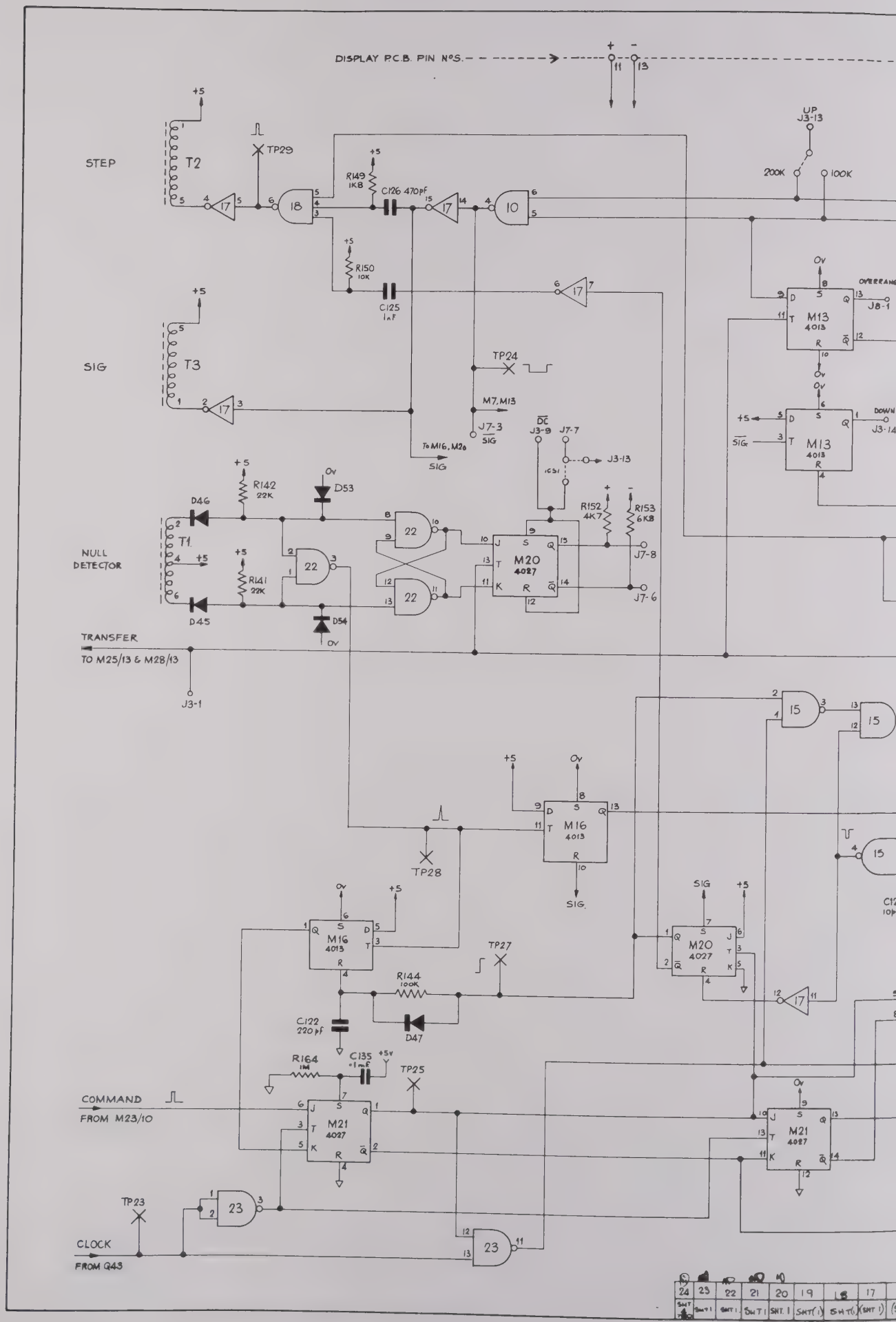
CHECK

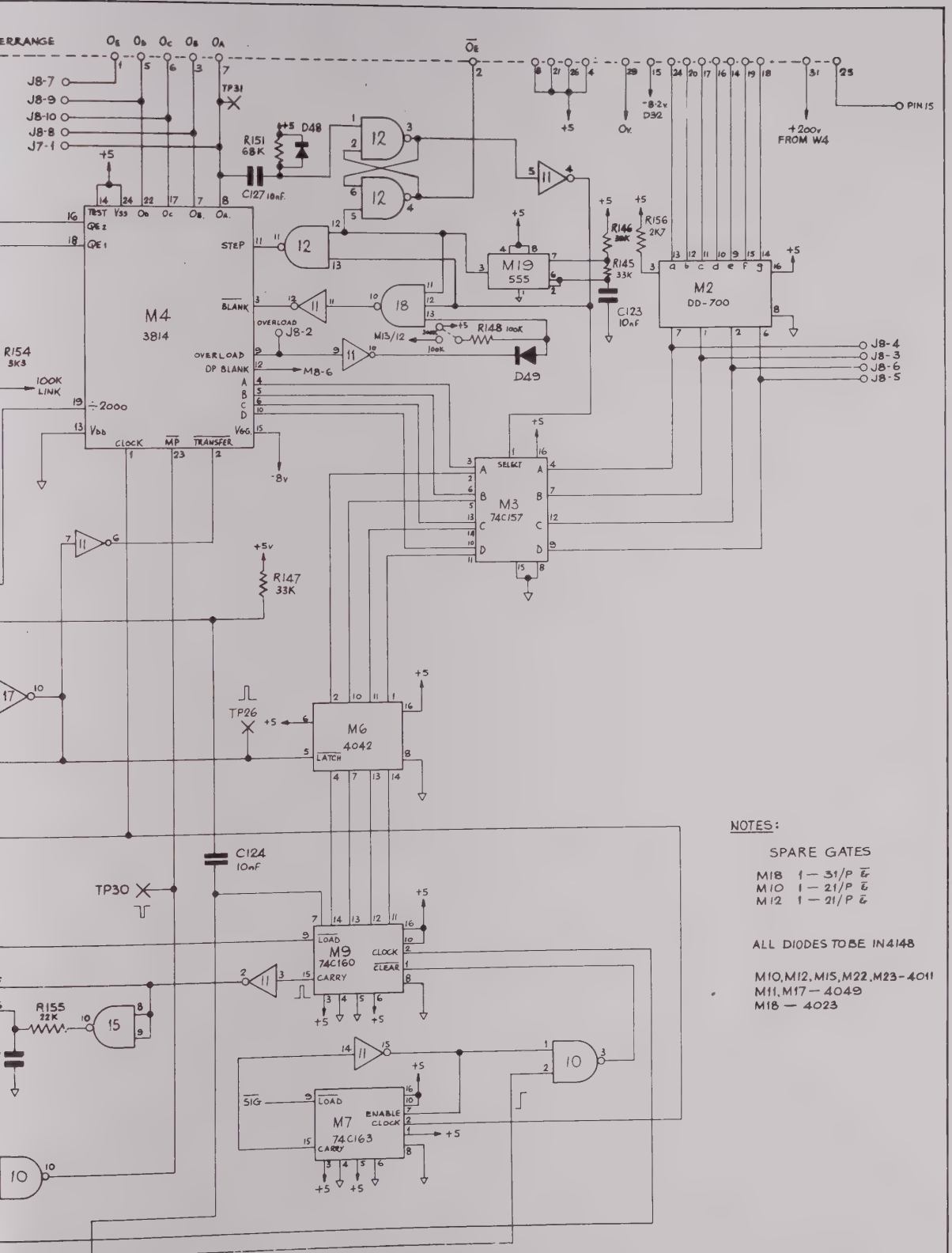
PROD. L.A.D. 2.2.77

1051 / 1251 A-D (DIGITAL)

430026

SHEET 2 OF 4


DISPLAY P.C.B. PIN Nos.
STEP
SIG
NULL DETECTOR
TRANSFER
TO M25/13 & M28/13
J3-1
COMMAND
FROM M23/10
CLOCK
FROM Q43
T1
T2
T3
TP29
TP24
TP28
TP27
TP25
TP23
R149 1K8
C126 470pF
R150 10K
C125 1nF
R142 22K
R141 22K
R144 100K
R164 1M
C135 0·1mF
C122 220pF
R152 4K7
R153 6K8
D46
D45
D53
D54
D47
M7, M13
M16, M26
J7-3
J7-8
J7-6
J3-13
J3-9
J7-7
UP
J3-13
200K
100K
OVERRANGE
J8-1
DOWN
J3-14
M13 4013
M16 4013
M20 4027
M21 4027
22
15
17
18
10
23



NOTES:

SPARE GATES

M18 1 — 31/P &
M10 1 — 21/P &
M12 1 — 21/P &

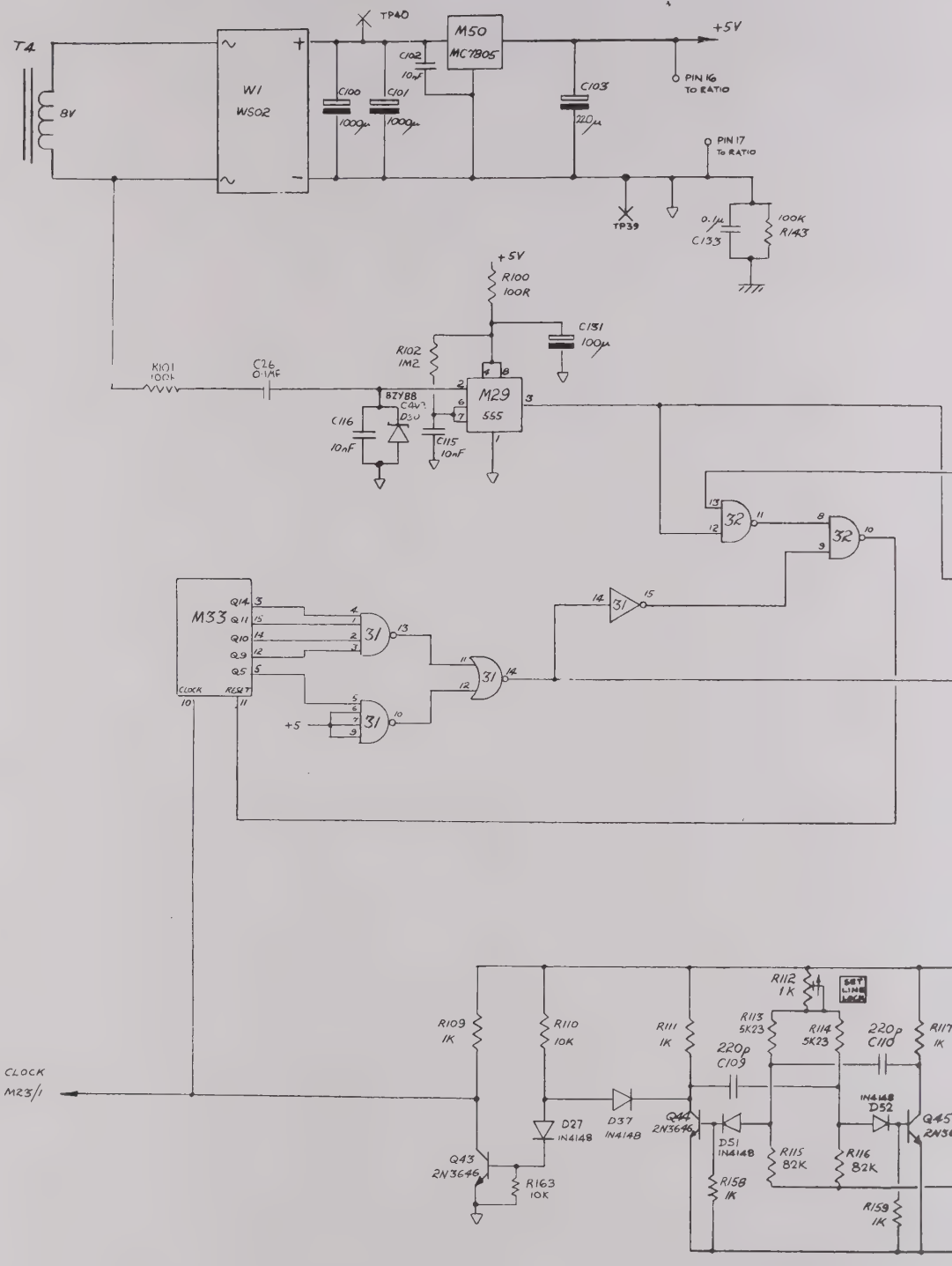
ALL DIODES TO BE IN4148

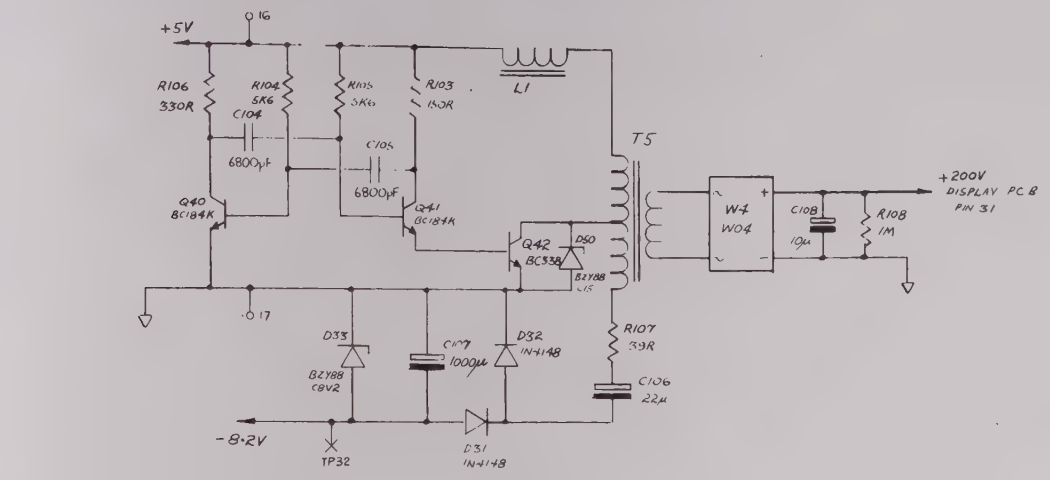
M10, M12, M15, M22, M23 - 4011
M11, M17 — 4049
M18 — 4023

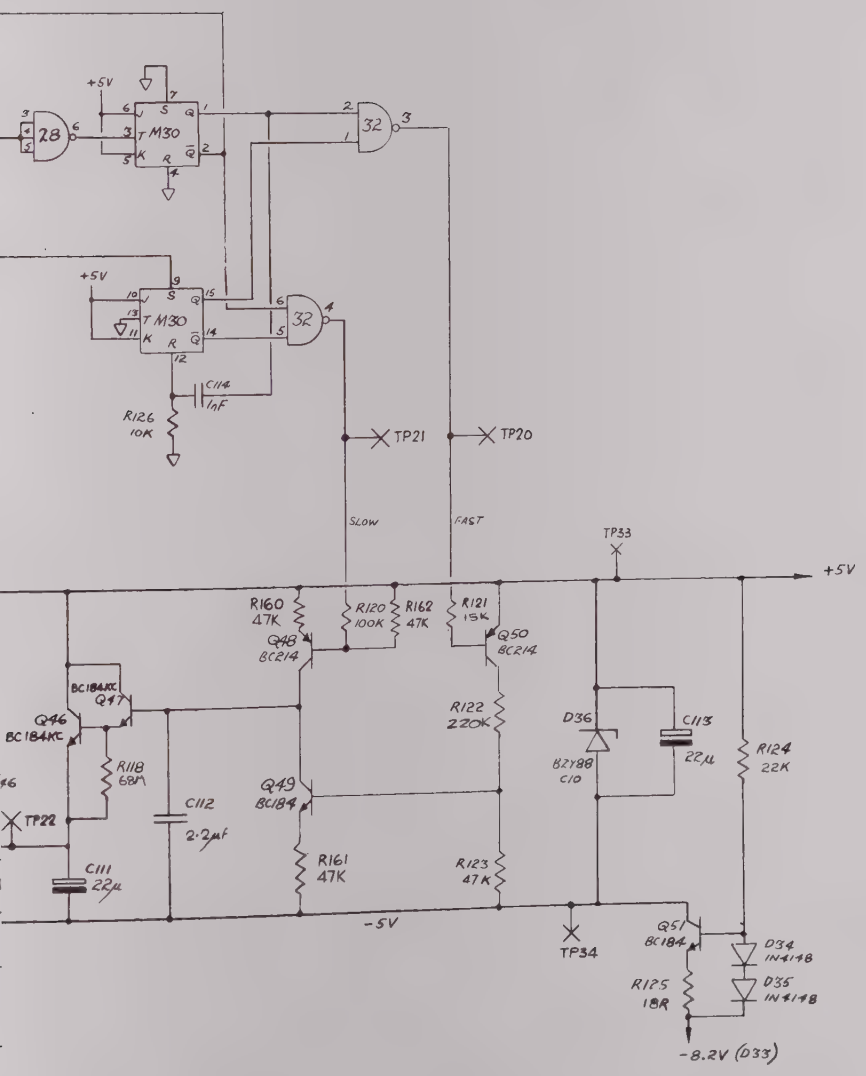
REVISION	DATE	datron ELECTRONICS LTD	
1	15.4.75	R&D IV	1051/1251 A-D SCHEMATIC
2 E.C.O. 72	31/7/75	CHECK	
3 ECO 111	3/10/75	PROD L.A.D. 2.2.77	430026
4 ECO.120	23/10/75		

SHEET 3 OF 4

16	15	14	13
(SHT1)	(SHT1)	(SHT1)	(SHT1)


T4
8V
W1
WS02
TP40
M50
MC7805
+5V
C100
1000µ
C101
1000µ
C102
10nF
C103
220µ
PIN 16
To RATIO
PIN 17
To RATIO
TP39
0.1µ
C133
100K
R143
+5V
R100
100R
C131
100µ
R102
1M2
K101
100K
C26
0.1MF
BZY88
C8V2
M29
555
C116
10nF
C115
10nF
32
32
31
31
31
31
M33
Q14
Q11
Q10
Q9
Q5
CLOCK
RESET
+5
CLOCK
M23/1
R109
1K
R110
10K
R111
1K
R112
1K
SET LINE LOCK
R113
5K23
R114
5K23
220p
C109
220p
C110
R117
1K
D27
IN4148
D37
IN4148
Q42
2N3646
Q43
2N3646
R163
10K
D51
IN4148
IN4148
D52
R115
82K
R116
82K
R158
1K
R159
1K





REV	DATE	REV	DATE	REVISION	DATE	datron ELECTRONICS LTD	
22	SHT 1	4	E.C.O 244 23.11.76		2/75	R&D	1051/1251 A-D
23	SHT 1	13	(SHT 1)				(SUPPLIES & LINE LOCKING)
24	SHT 4 7.80	14	(SHT 1)	1 E.C.O. 70	14/7/75		
		15	(SHT 1)				
		16	(SHT 1)	2 E.C.O. 72	31/7/75	L.A.D. 2.3.77	430026 SHT 4 OF 4
		17	(SHT. 1)				
		18	(SHT. 1)				
		19	(SHT. 1)	3 E.C.O. 126	23/10/75		
		20	(SHT. 1)				
		21	(SHT 1)				

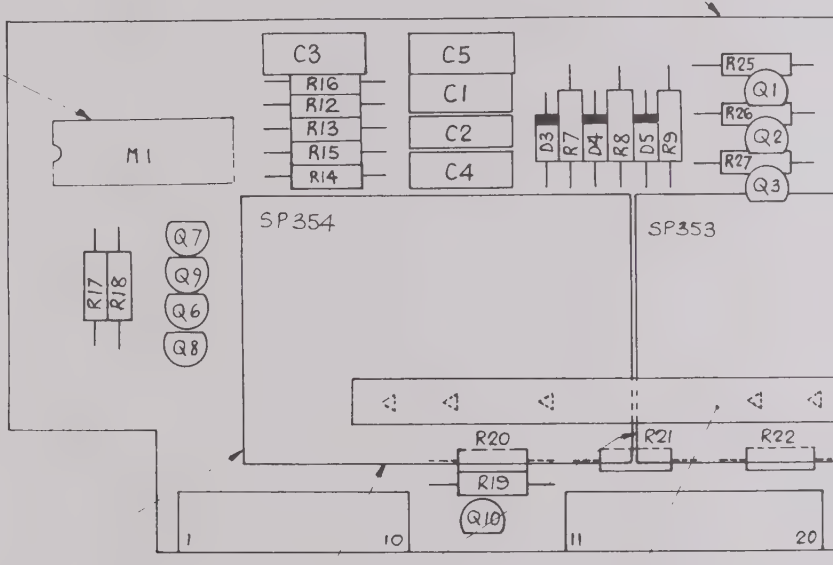
DRAWING No.
400088
FIRST USED ON 1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

PRINTED CIRCUIT BO
410018-3

1 OFF D.I.L. SOCKET
605038



1 OFF SPERRY ·5" DISPLAY
800 012

2 OFF SPERRY SOCKET
800 010

FIT STRIP OF BLACK CREPE PAPER TAPE OVER KEEP ALIVE PINS. 630030

DRAWN IV	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ° INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ± 4mm UNLESS OTHERWISE STATED	MATERIAL /
TRACED	APPROVED L.A.B.	SCALE 2:1		FINISH /
DATE	DATE 2.2.77	NOT TO BE SCALED		

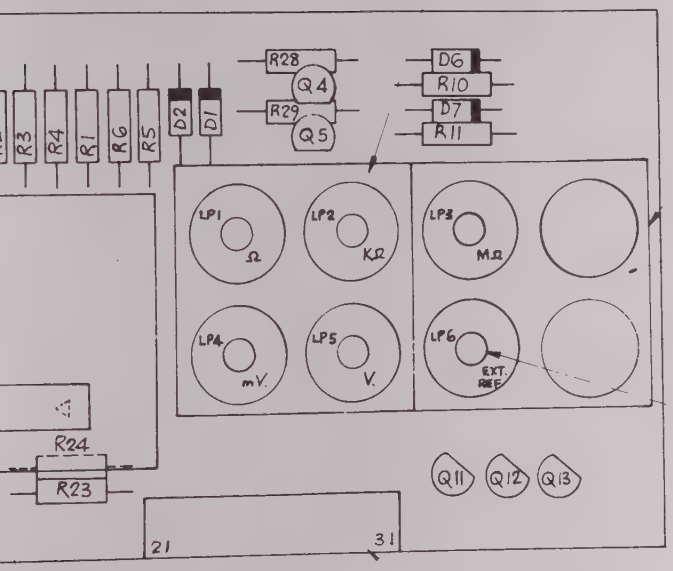
J.W.T.S.2

4	5	6
ALL BURRS TO BE REMOVED		NOTES

ISS.	CHANGE
2	ECO.117 REDRAWN TO REVISED TRACK LAYOUT. 7.10.75
3	ECO 319 25.11.76 PCB NOW ISS 3 PSH.
4	ECO 508 5.7.77 DIL SOCKET CHANGE PJH

RD

1 OFF 'Ω, KΩ' NEGATIVE LABEL
420 013



2 OFF WASHERS M3 SHAKEPROOF.
613005
2 OFF FUNCTION BLOCK
450 003
2 OFF FIXING SCREW
611 014
1 OFF 'MΩ' NEGATIVE LABEL
420 030

6 OFF FILAMENT LAMP
920 005

3 OFF 11-WAY CONNECTOR STRIP
604003

1 OFF SPERRY ·5" DISPLAY
800 003

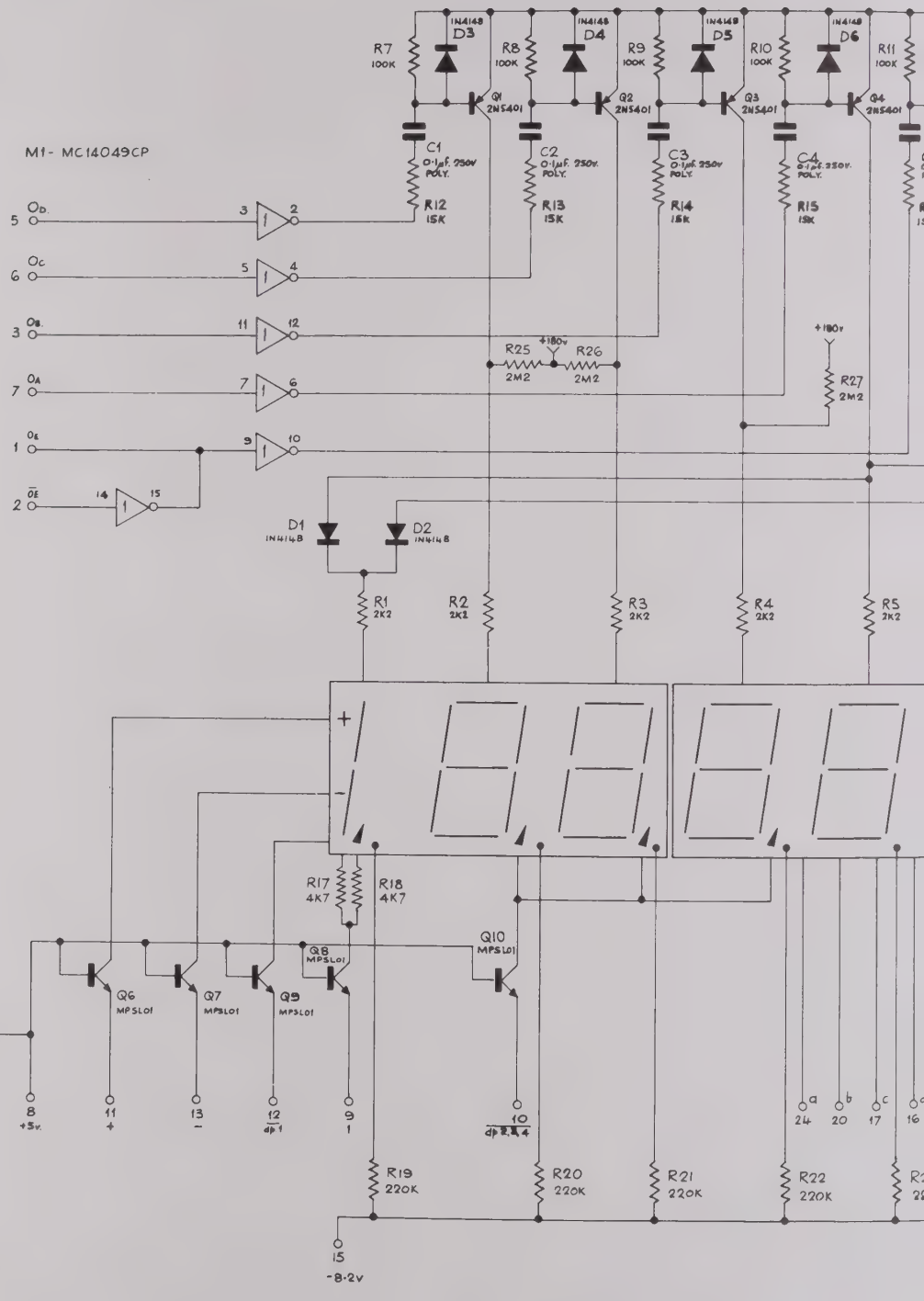
datron ELECTRONICS LTD. NORWICH.

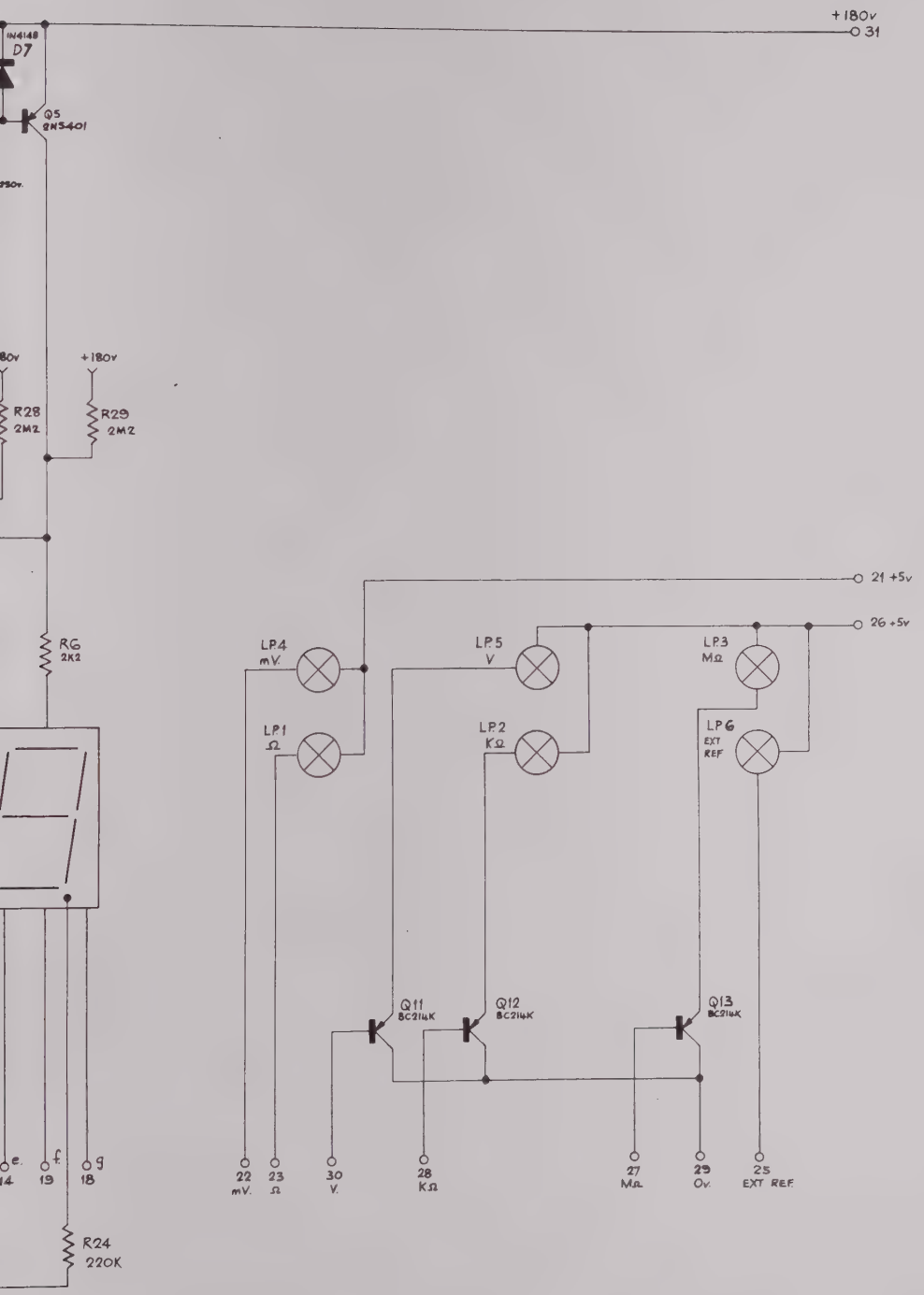
DRAWING SIZE A2

TITLE 1051 - ·5" SPERRY DISPLAY P.C.B. ASSY

DRAWING No. 400088

SHEET 1 OF 5


M1- MC14049CP
IN4148
D3
D4
D5
D6
R7 100K
R8 100K
R9 100K
R10 100K
R11 100K
Q1 2N5401
Q2 2N5401
Q3 2N5401
Q4 2N5401
C1 0·1μF. 250V. POLY.
C2 0·1μF. 250V. POLY.
C3 0·1μF. 250V. POLY.
C4 0·1μF. 250V. POLY.
R12 15K
R13 15K
R14 15K
R15 15K
OD
OC
OB
OA
OE
OE
+180v
R25 2M2
R26 2M2
R27 2M2
D1 IN4148
D2 IN4148
R1 2K2
R2 2K2
R3 2K2
R4 2K2
R5 2K2
R17 4K7
R18 4K7
Q6 MPSL01
Q7 MPSL01
Q8 MPSL01
Q9 MPSL01
Q10 MPSL01
4 +5v.
8 +5v.
11 4
13 –
12 dp 1
9 1
10 dp 2,3,4
a 24
b 20
c 17
16
R19 220K
R20 220K
R21 220K
R22 220K
15 -8·2v



REVISION	DATE	datron ELECTRONICS LTD	
2 REDRAWN	8 4 75	R&D I V	1051 ·5" SPERRY DISPLAY SCHEMATIC
3 E.C.O. 71	23.7 75	CHECK DCB	
4 E.C.O. 117	21.10.75	PROD L.A.Dunn 2.2.77	430020
			SHEET 1 OF 1

DRAWING No.	
400091	
FIRST USED ON	1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308

TEST POINT LOOPS (TP1 ETC.)
MADE FROM 22 SWG BTC
WIRE (540002)
CUT TO SUIT.

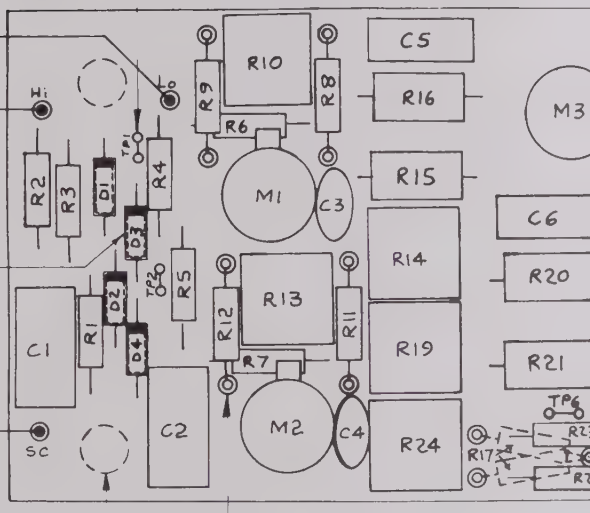
EXT. REF. REAR INPUT SOCKET

BLUE PIN D

RED PIN E

GREEN PIN H

SLEEVE DIODES D1-D4
WITH BLACK SLEEVING
(590011)



11 OFF F.S.V TERMINAL
602001

4 OFF M3 STANDOFF
612006
FITTED FROM TRACK
SIDE OF P.C.B.

DRAWN	CHECKED
M.J.D.	
TRACED	APPROVED
	L.A.D.
DATE	DATE
6.2.76	6/76

DIMENSIONS IN
MILLIMETRES

SCALE
2 : 1
NOT TO BE SCALED

TOLERANCES ANGULAR ± .°
INCH DIMENSIONS
DECIMAL TO 3 PLACES ± .005
DECIMAL TO 2 PLACES ± .010
FRACTIONAL ± 1/64
METRIC DIMENSIONS
DECIMAL TO 2 PLACES ± .1mm
DECIMAL TO 1 PLACE ± .2mm
WHOLE DIMENSIONS ± 4mm
UNLESS OTHERWISE STATED

MATERIAL

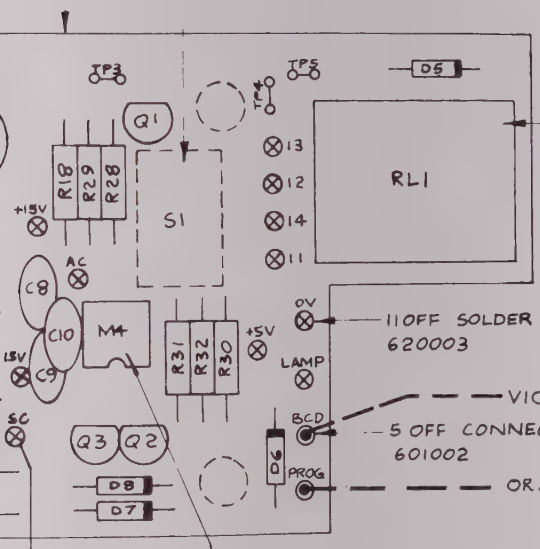
FINISH

4	5	6
ALL BURRS TO BE REMOVED		NOTES

BS.	CHANGES
3	REDRAWN NEW LAYOUT M.J.D. 6.2.76
4	REVISED TO 156.6 ARTWORK 10.3.76.
5	D1-D4 SLEEVED ECO 276 PJN
6	ECO. 693. 30.5.78 PARTS LIST MOD. L.
7	C1&C2 WERE 0·68μF ECO 760 8 NOV 78 W.G.S.
8	C7, R25&R26 DELETED M3 WAS UNCH. ECO 773/751 24 NOV 78 W.G.S.
9	R2-R5 WAS 000006 E.C.O.768 26·FEB·79 W.G.S

P.C. BOARD.
410015-6

SWITCH 700019 FITTED
ON TRACK SIDE OF P.C.B.



RELAY SOCKET 602007
SOLDERED INTO P.C.B.

28V RELAY 330003
PRESSED INTO SOCKET

USE CLIP 630005
TO RETAIN RELAY

11 OFF SOLDER TERMINAL
620003

VIOLET FROM B.C.D. (IF FITTED)

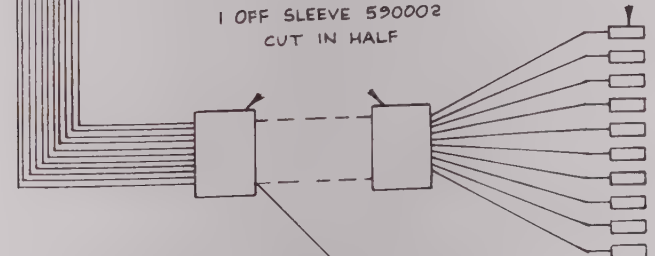
5 OFF CONNECTOR TERMINAL
601002

ORANGE FROM PIN 7 PROG. SKT. (IF FITTED)

11 OFF SNAP CONNECTOR 602003
AND SLEEVE 590001

M4 MOUNTED DIRECTLY
INTO P.C.BOARD.

1 OFF SLEEVE 590002
CUT IN HALF



LEADS OFF TO A-D ASSY. (ANAL. SECTION).		
FUNCTION	COLOUR	LENGTH
+15V	RED	100 mm
-15V	BLUE	"
AN. COM.	GREEN	"
-5V. REF. SENSE-OUT (11)	BROWN	"
EXT. REF. SENSE-IN (12)	WHITE	"
-5V. REF. DRIVE-OUT (13)	WHITE/RED	"
EXT. REF. DRIVE-IN (14)	ORANGE/BLACK	"
DIGITAL OV.	PINK	"
+5V. POWER	RED/BLACK	"
LAMP DRIVE	GREY	"

TO D.C. ISOLATOR — BLACK/270 LONG

datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE RATIO AMP (1V I/P) ASSY. 1059/1051

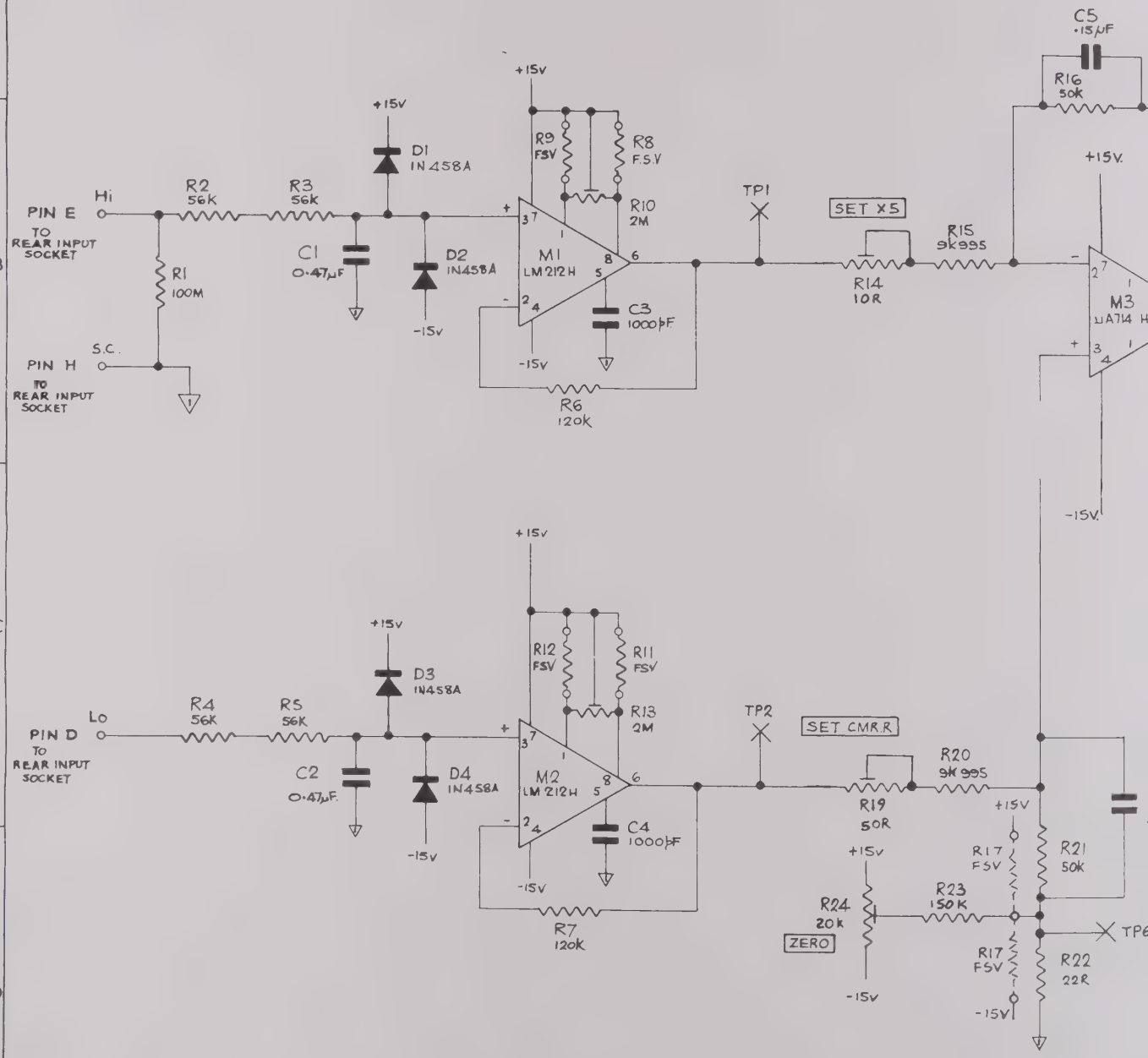
DRAWING No. 400091

SHEET 1 OF 6

DRAWING No.	
430028	
FIRST USED ON	1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN IV	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES ANGULAR ± ° INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ± 4mm UNLESS OTHERWISE STATED	MATERIAL /
TRACED	APPROVED L.A.B.	SCALE / NOT TO BE SCALED		FINISH /
DATE 5.11.75	DATE 6/76			

J W 1142

4 | 5 | 6

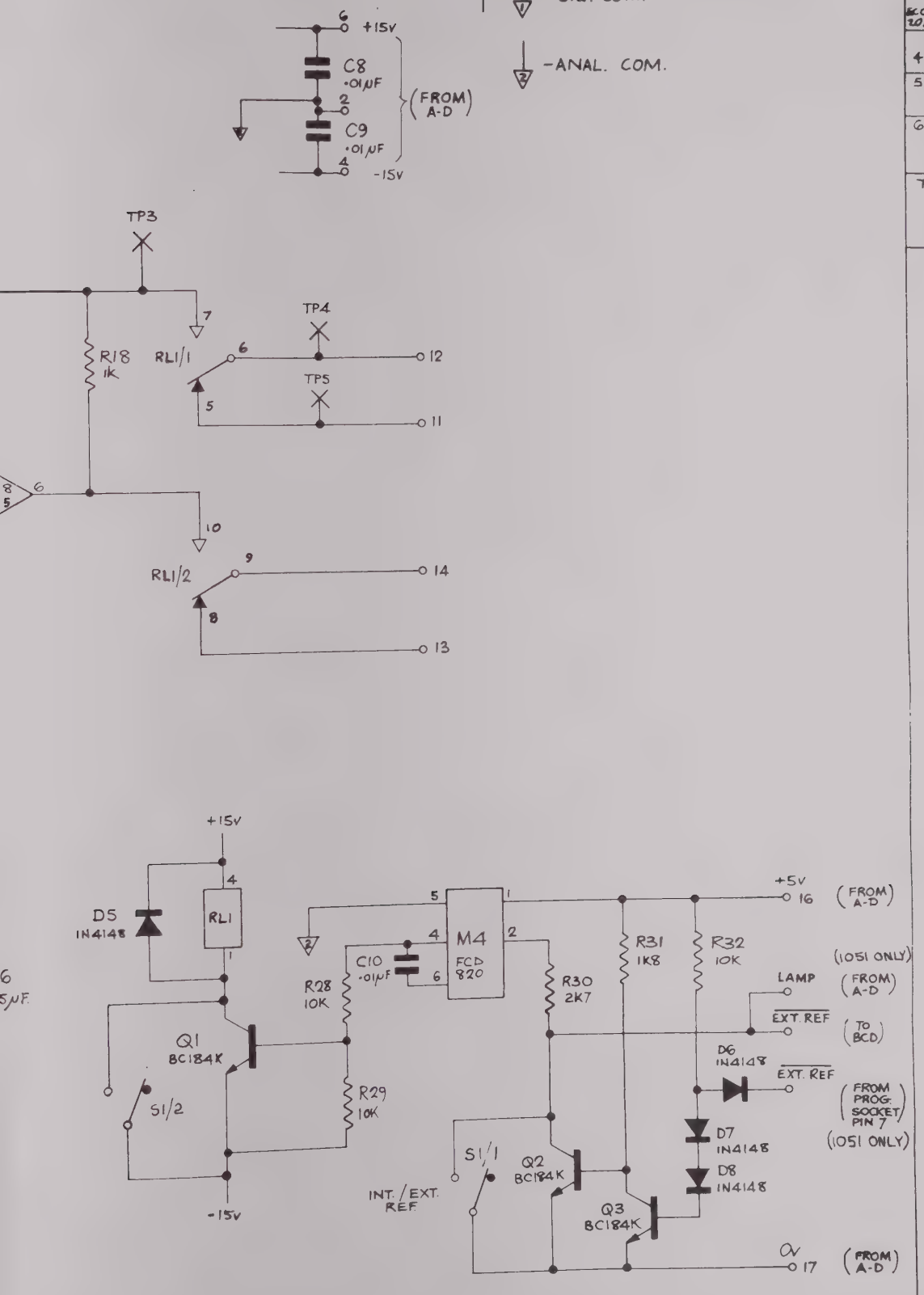
L BURRS TO BE REMOVED

NOTES

- SIG. COM.

- ANAL. COM.

ISS.	CHANGES
2	BCO 128 REDRAWN
3	D9; R27, 33, 34 DELETED. S1/2 ADDED. ECO 203 M3D. 16.3.76
4	ECO. 693. 30.5.78 M3 WAS LM301 DEVICE. L
5	C1&C2 WERE 0·68µF ECO 760 8 NOV 78 W.G.S.
6	C7, R25 & R26 DELETED M3 WAS LM101. ECO 773/751. 28-NOV-78 W.G.S
7	R2-R5 WAS 00 B0006 ECO 788 26-FEB-79 W.G.S



DRAWING SIZE A2

datron ELECTRONICS LTD. NORWICH.

TITLE 1059/1051 - RATIO AMPL & SWITCHING (1v. I/p)

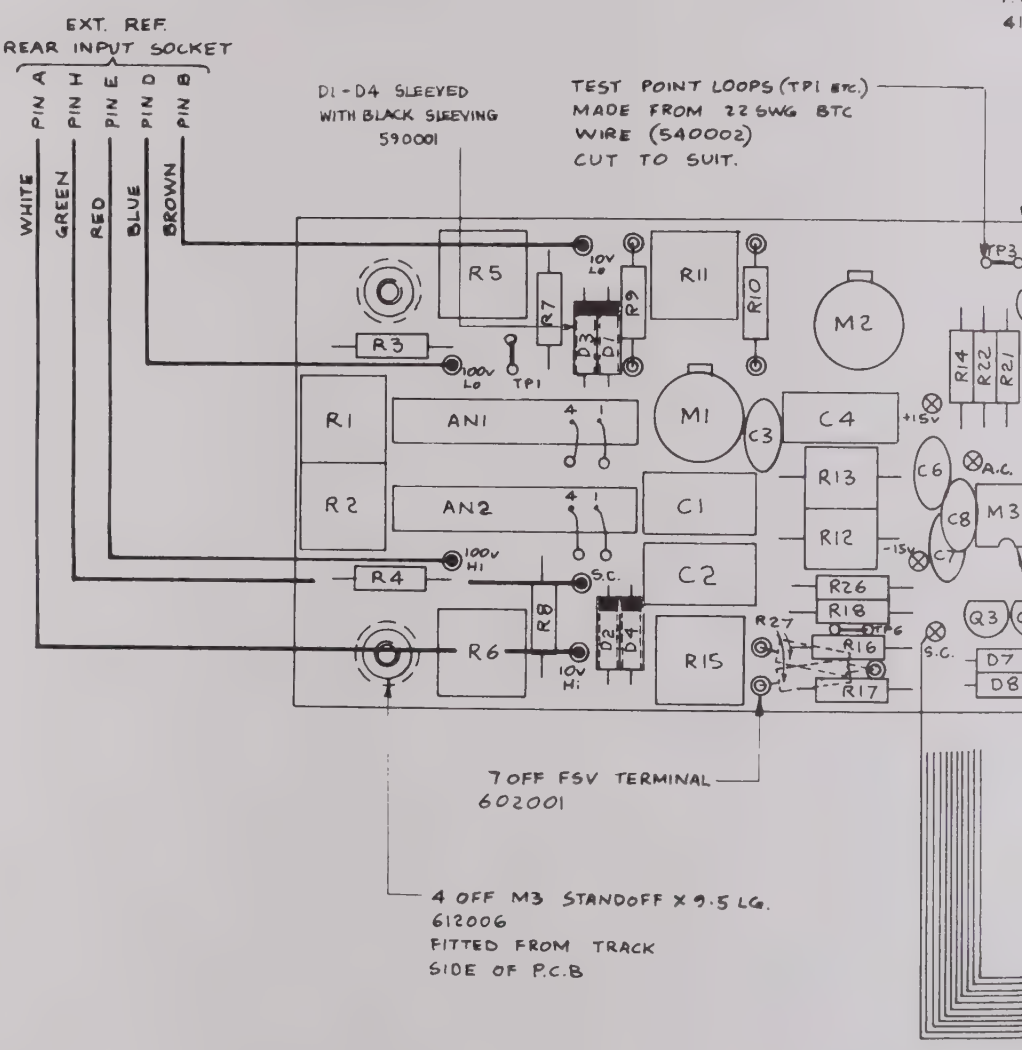
DRAWING No. 430028

SHEET 1 OF 1

DRAWING No.	
400125	
FIRST USED ON	1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES ANGULAR ± ½°	MATERIAL
M.J.D.		MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64 METRIC DIMENSIONS DECIMAL TO 2 PLACES ± .1mm DECIMAL TO 1 PLACE ± .2mm WHOLE DIMENSIONS ∓ .4mm UNLESS OTHERWISE STATED	
TRACED	APPROVED	SCALE 2:1		FINISH
DATE 27-8-76	DATE 1-9-76	NOT TO BE SCALED		

4	5	6
ALL BURRS TO BE REMOVED		NOTES

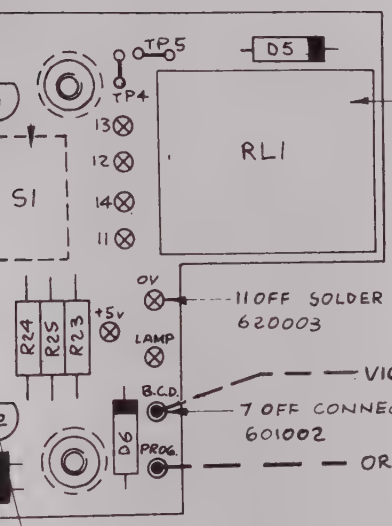
NOTES

1. THE FOLLOWING DIODES ARE TO BE SLEEVED WITH BLACK SLEEVES (590001). D1 TO D4 (4 OFF).

ISS.	CHANGES
2	ECO 269 REDESIGNED M.J.D. 21/8.76
3	ECO 277 [illegible] 14.9.76 DIODES D1-D4 SLEEVED
4	ECO. 694. 25.5.78 PARTS LIST MOD. IL.
5	C1 & C2 WERE O.S.L.M ECO 720 8 NOV 78. W.G.S.
6	C5, R19 & R20 DELETED M2 WAS LM101. ECO 775/751. 24 NOV 78 W.G.S.

BOARD
037-3

SWITCH 700019 FITTED ON TRACK SIDE OF P.C.B.



RELAY SOCKET 602007 SOLDERED INTO P.C.B.

28V RELAY 330003 PRESSED INTO SOCKET

USE CLIP 630005 TO RETAIN RELAY

11 OFF SOLDER TERMINAL 620003

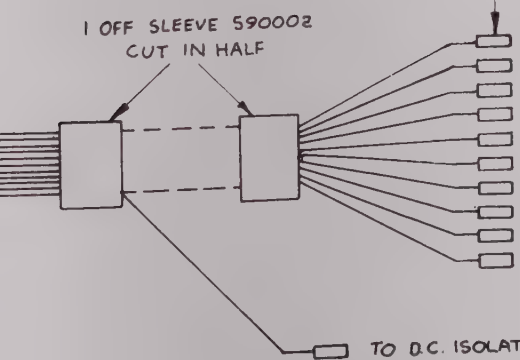
VIOLET FROM B.C.D. (IF FITTED)

7 OFF CONNECTOR TERMINAL 601002

ORANGE FROM PIN 7 PROG. SKT (IF FITTED)

11 OFF SNAP CONNECTOR 602003 AND SLEEVE 590001 (FIT SLEEVES OVER SNAP CONNECTORS AND SOLDER TERMINALS)

1 OFF SLEEVE 590002 CUT IN HALF



LEADS OFF TO A-D ASSY. (ANAL. SECTION).		
FUNCTION	COLOUR	LENGTH
+15V	RED	100 mm
-15V	BLUE	"
AN. COM.	GREEN	"
-5V. REF. SENSE-OUT (11)	BROWN	"
EXT. REF. SENSE-IN (12)	WHITE	"
-5V. REF. DRIVE-OUT (13)	WHITE/RED	"
EXT. REF. DRIVE-IN (14)	ORANGE/BLACK	"
DIGITAL OV.	PINK	"
+5V POWER	RED/BLACK	"
LAMP DRIVE	GREY	"

TO D.C. ISOLATOR - BLACK/270 LONG

datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE RATIO AMP (10/100V I/P) ASSY, 1051

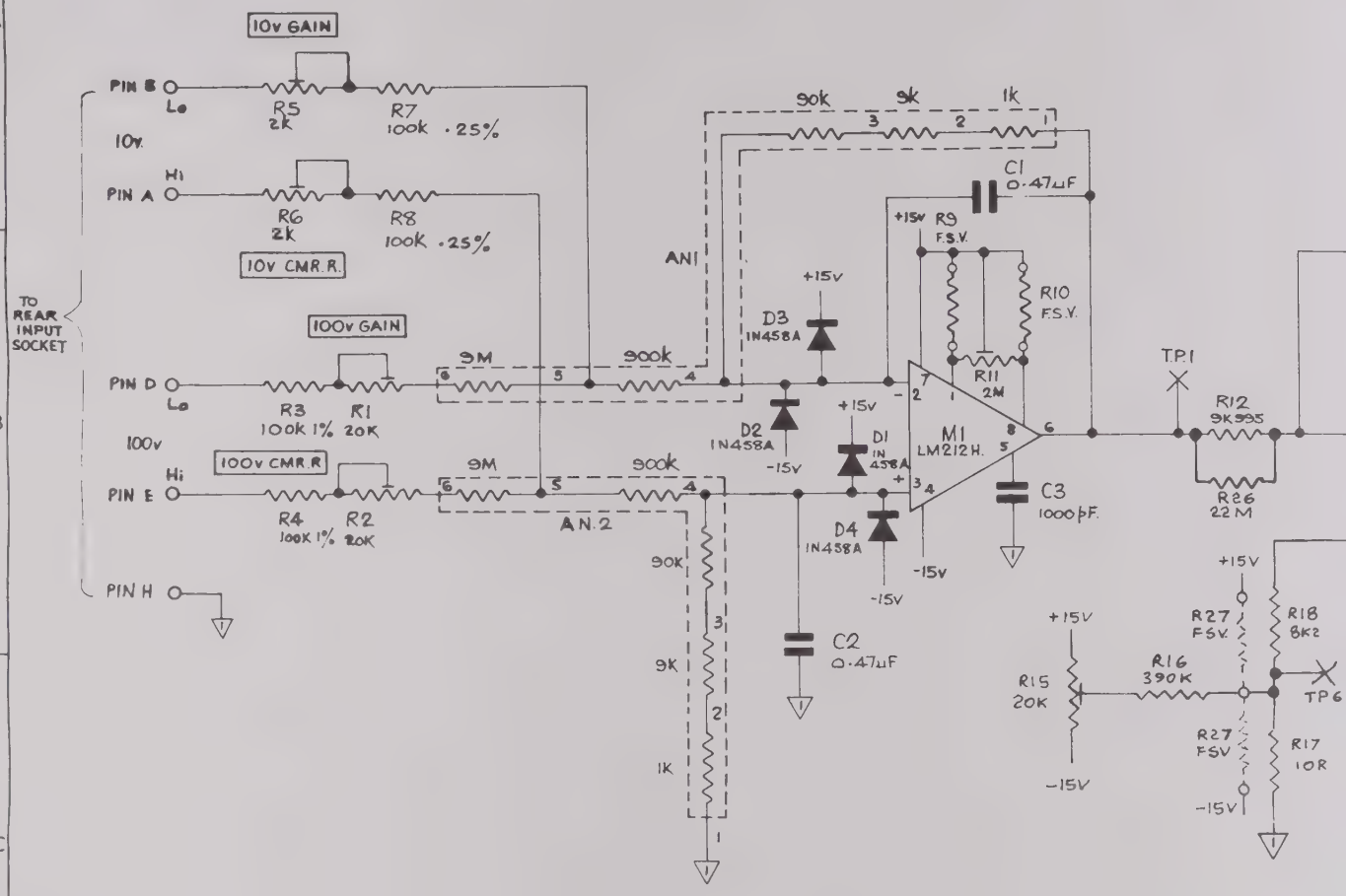
DRAWING No. 400125

SHEET 1 OF 6

DRAWING No.	
430032	
FIRST USED ON	1051

THIRD ANGLE PROJECTION

DRAWN IN ACCORDANCE WITH BS 308



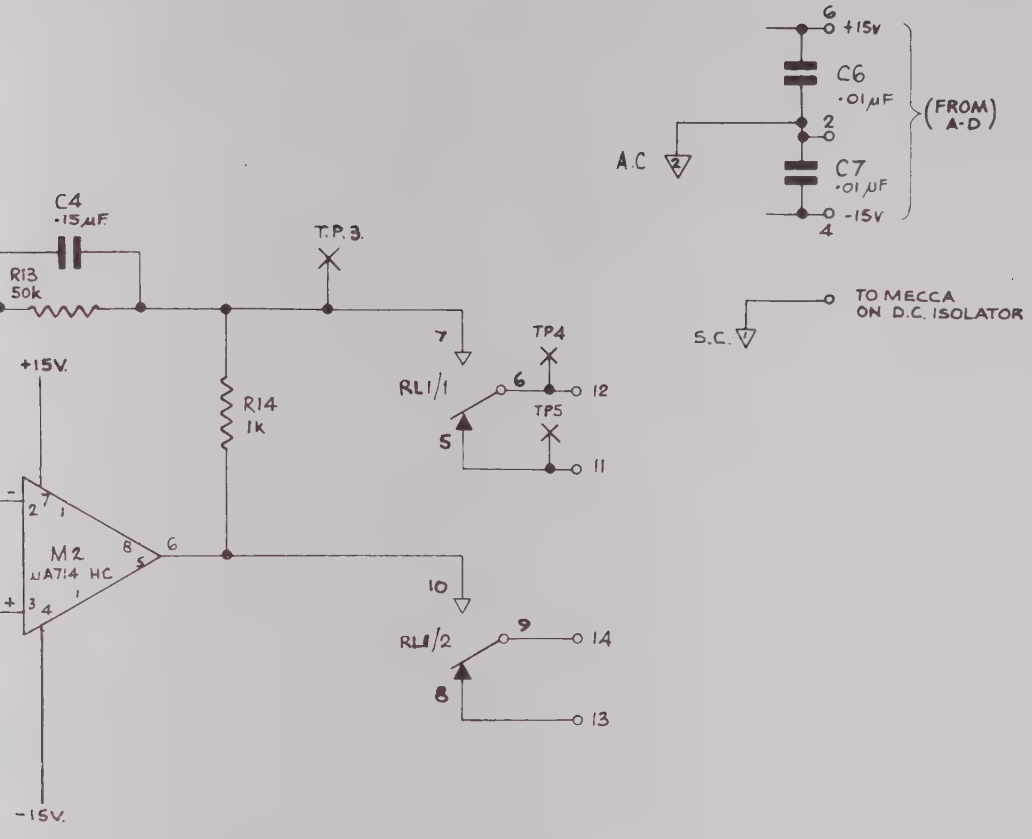
DRAWN	CHECKED	DIMENSIONS IN	TOLERANCES ANGULAR ± .°	MATERIAL
IV		MILLIMETRES	INCH DIMENSIONS DECIMAL TO 3 PLACES ± .005 DECIMAL TO 2 PLACES ± .010 FRACTIONAL ± 1/64	/
TRACED	APPROVED L.A.D.	SCALE /	METRIC DIMENSIONS DECIMAL TO 2 PLACES ± 1mm DECIMAL TO 1 PLACE ± 2mm WHOLE DIMENSIONS ± 4mm	FINISH /
DATE 3.11.75	DATE 2.2.77	NOT TO BE SCALED	UNLESS OTHERWISE STATED	

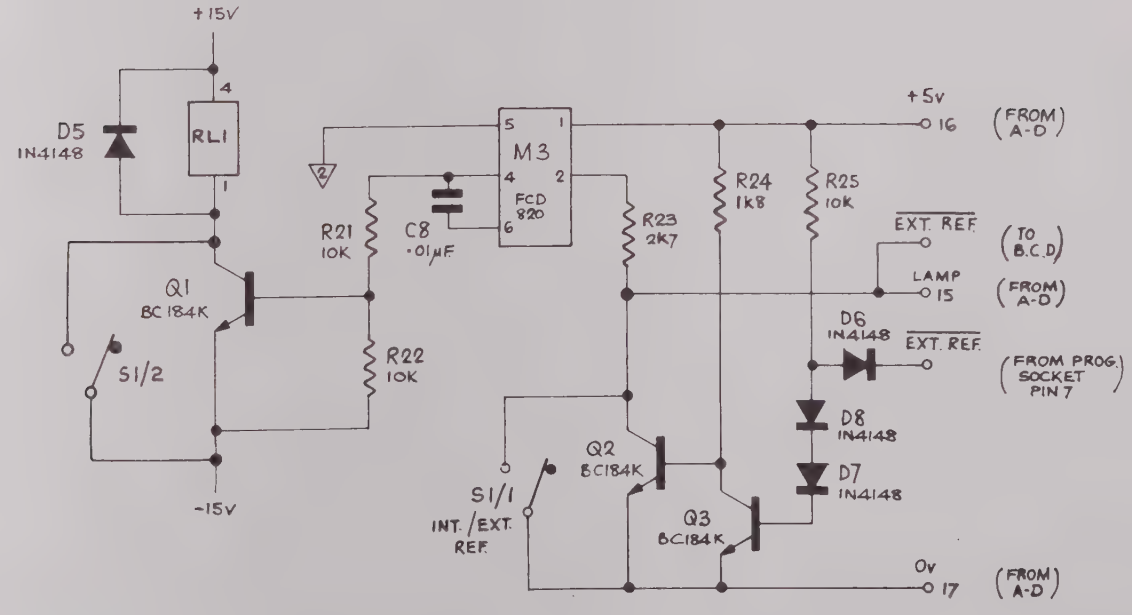
4 | 5 | 6

LL BURRS TO BE REMOVED

NOTES

ISS.	CHANGES
1	RELEASED TO PROD. 7.8.75
2	ECO 289 REDESIGNED. M.J.D. 31.8.76.
3	ECO. 694. 20.5.78 M2 WAS LM301 DEVICE. L.
4	C1 & C2 WERE 0·68µF ECO 760 8 NOV 78. W.G.S.
5	C7. R19 & R20 DELETED M2 WAS LM101. ECO 775/751. 24-NOV-78. W.G.S.





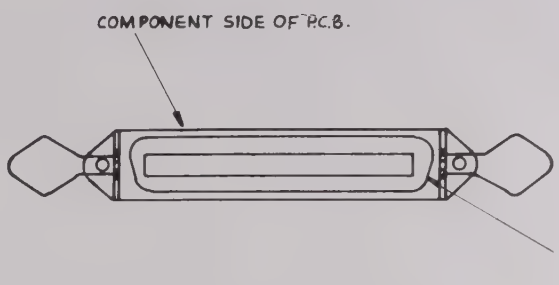
datron ELECTRONICS LTD. NORWICH.

DRAWING SIZE A2

TITLE 1051 – RATIO AMPL & SWITCHING (10v/100v I/P)

DRAWING No. 430032

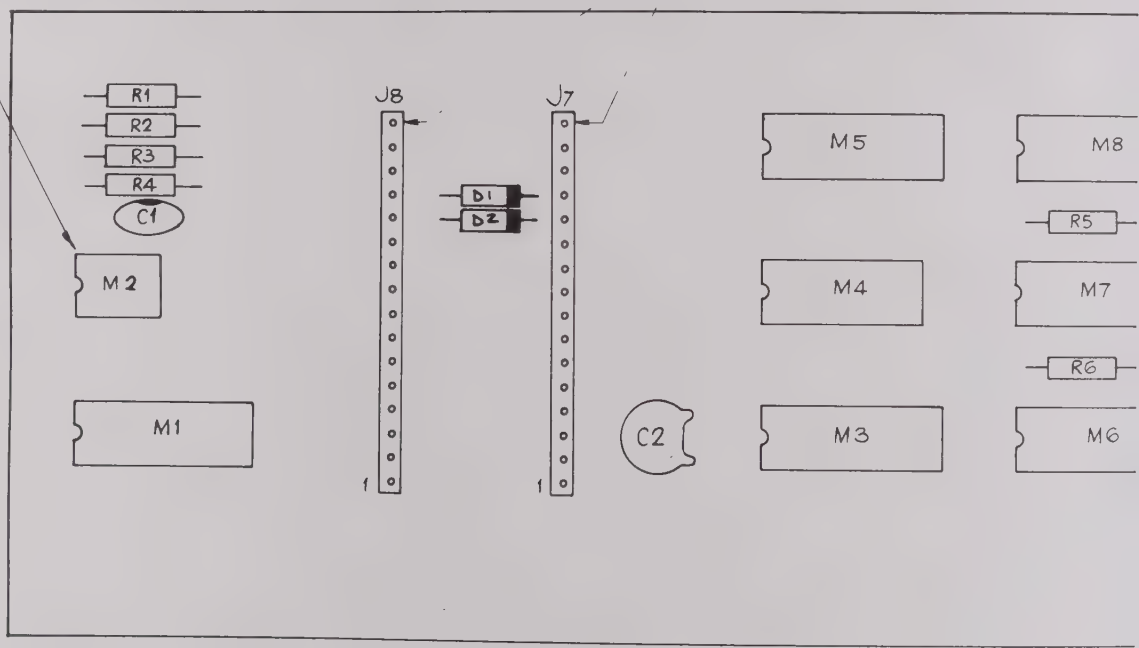
SHEET 1 OF 1



1:1 VIEW ON ARROW 'A' TO SHOW
ORIENTATION OF CONNECTOR/P.C.B.

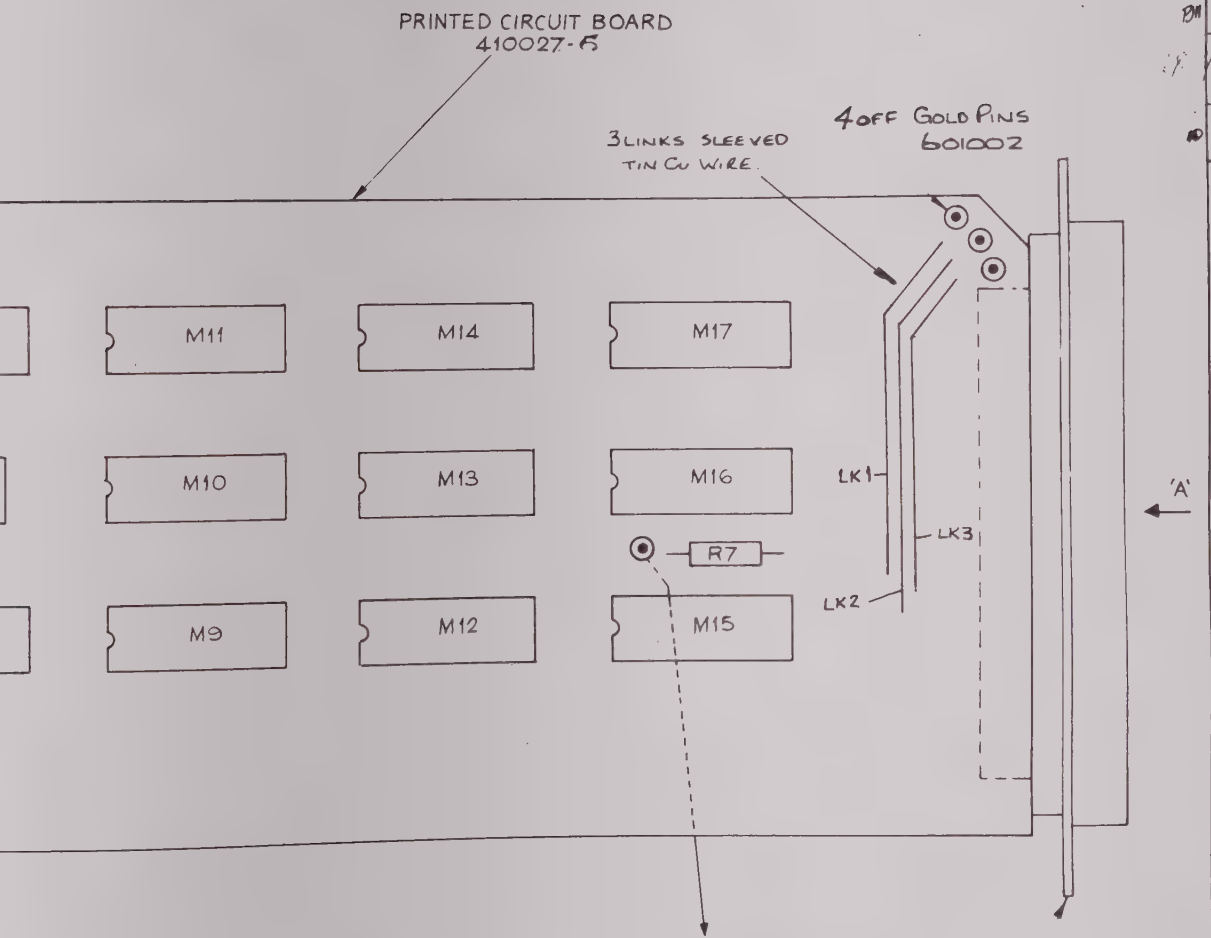
FIT PIN SHOULDERS
TO SOCKET END

M2 MOUNTED ON SOCKET
PART No 605059.



DRAWN IV.	CHECKED	DIMENSIONS IN MILLIMETRES	TOLERANCES	MATERIAL
TRACED	APPROVED L.A.B.	SCALE 2:1 NOT TO BE SCALED	METRIC DIMENSIONS DECIMAL TO 2 PLACES ± ·1mm DECIMAL TO 1 PLACE ± ·2mm WHOLE DIMENSIONS ± ·4mm UNLESS OTHERWISE STATED.	FINISH
DATE 14.4.75	DATE 2.2.72			

	[redacted] ADDED. CORNER OF BOARD SHOWN CROPPED OFF IV 30/10/78
3	ECO 207 PCB WAS -2 M.J.D. 6.5.76.
4	ECO 234 7.9.76 PT. LT. CHANGE PJH
5	ECO 310 5.11.76 PCB WAS -4 PJH
6	ECO 507 change to Astralux dil Socket 5.7.77 PJH
7	ECO. 559 23.9.77 PARTS LIST MOD. ONLY
8	ECO. 558 23.9.77 M3 STANDOFF DELETED. IL
9	ECO 645 30-3-78 GOLD PINS B.I. LINKS & DIODES ADDED.
10	ECO 733 PARTS LIST MOD 31-8-78 W.G.S.



NOTES: ITEMS ALSO REQD. FOR P.C.B. ASSY ARE :-
2 OFF 14-WAY D.I.L. SOCKET 605037
14 OFF 16-WAY D.I.L. SOCKET 605038

1 OFF 50-WAY. AMP SOCKET 605 001

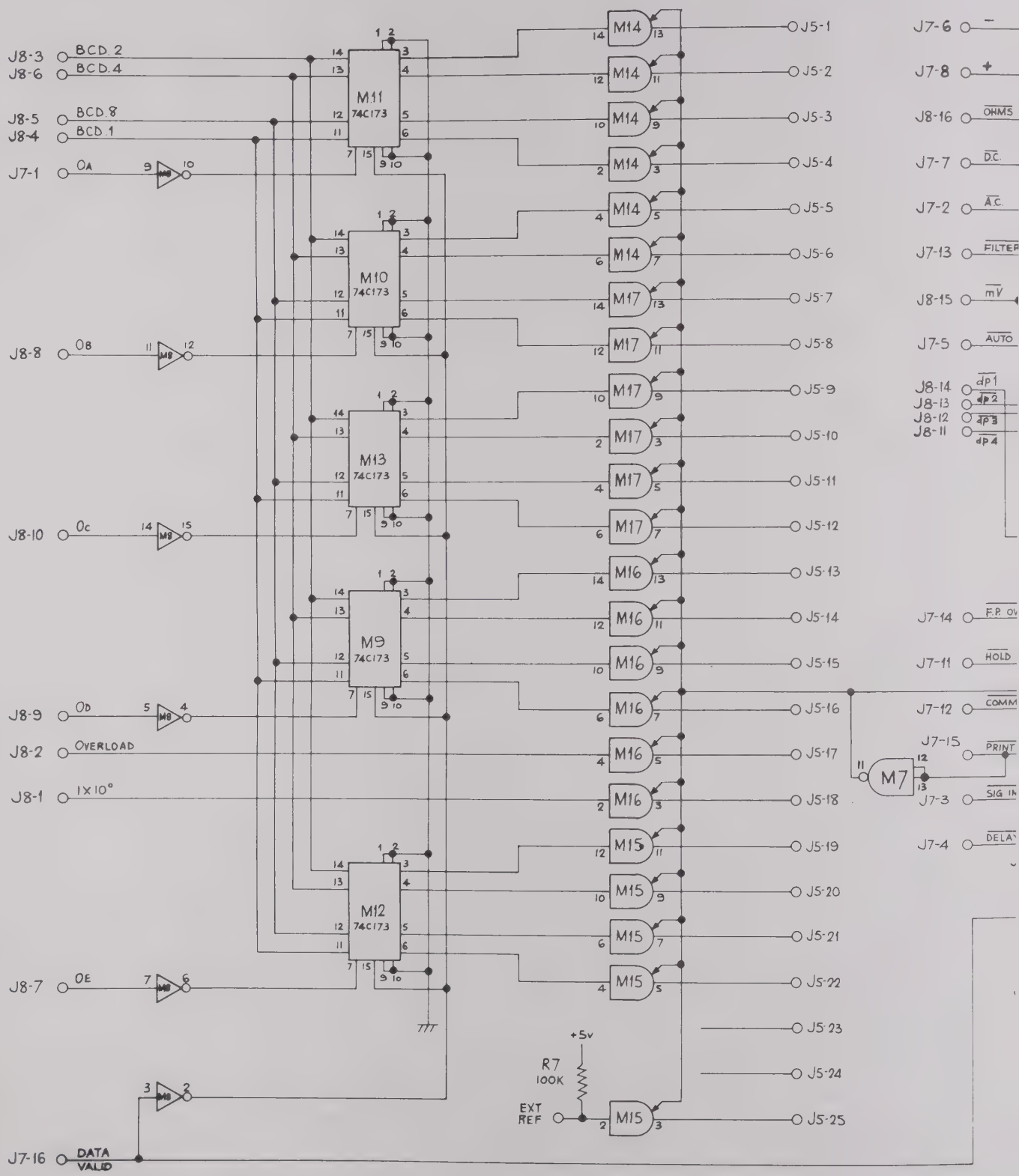
datron ELECTRONICS LTD., NORWICH

DRAWING SIZE A2

TITLE 1059/1051 B.C.D. OUTPUT P.C. BOARD ASSY.

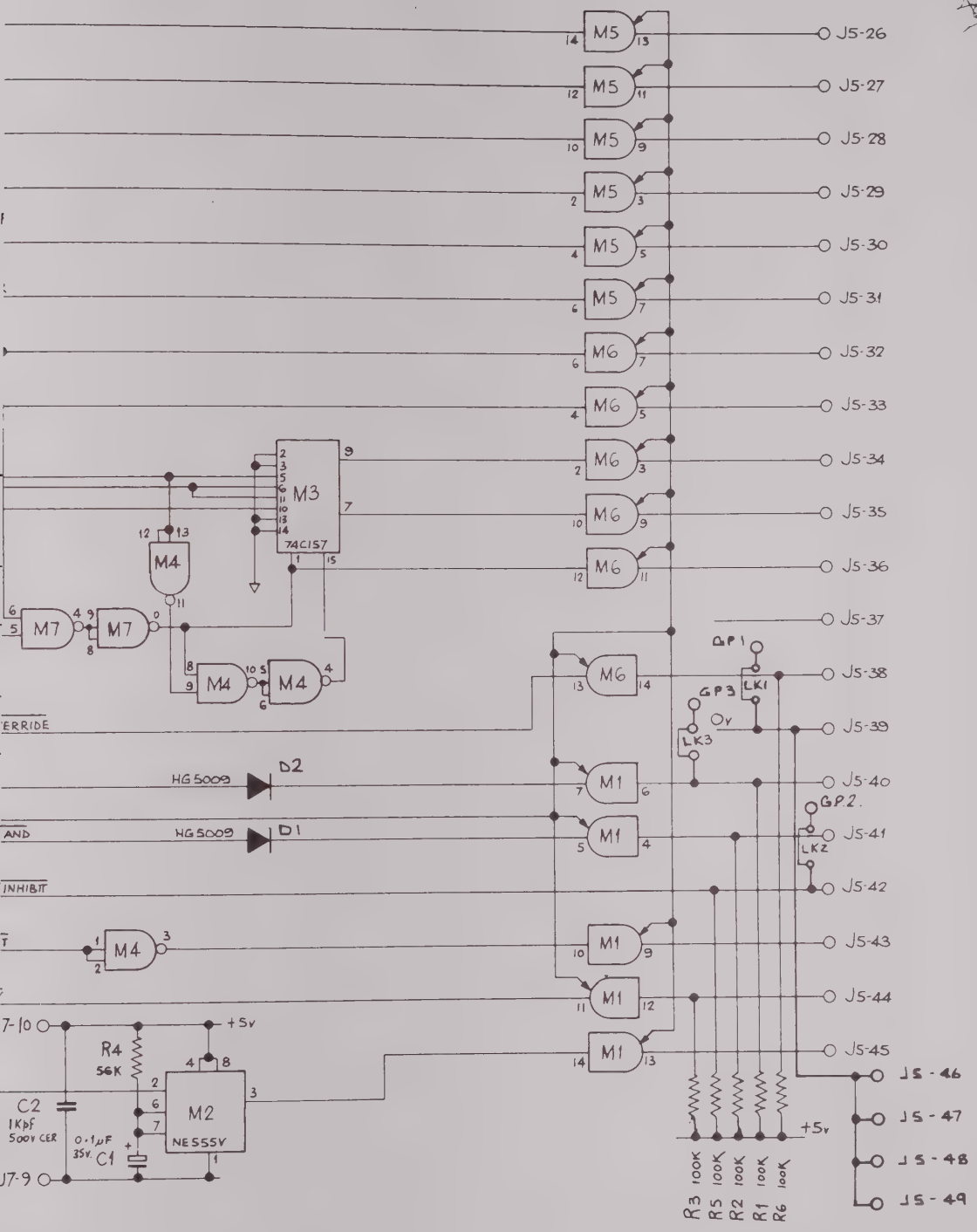
DRAWING Nº 400095.

SHEET 1 OF 3



DRAWN I.V.	CHECKED I.M.	DIMENSIONS IN MILLIMETRES	TOLERANCES	MATERIAL
TRACED	APPROVED L.A.D	SCALE NOT TO BE SCALED	METRIC DIMENSIONS DECIMAL TO 2 PLACES ± .1mm DECIMAL TO 1 PLACE ± .2mm WHOLE DIMENSIONS ± .4mm UNLESS OTHERWISE STATED	FINISH
DATE 11.4.75	DATE 2.2.77			

ISS	CHANGES
2	ECO.560 23.9.77 R4 WAS 39k
3	ECO645 B.J 30-3-78



M1, M5, M6, M14–M17 = 80C95
M4, M7 = 14011
M8 = 14049

G.P. = Gold Pin
L.K = Link

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DRAWING SIZE A2

TITLE 1051 / 1055 / 1059 B.C.D OUTPUT SCHEMATIC.

DRAWING No 430022

SHEET 1 OF 1

ADDENDUM AND ERRATA SHEETS INDEX

INSTRUMENT:

SERIAL NO:

COMPONENT PARTS AND SERIAL NOS.	ASSOCIATED UPDATE SHEETS

ERRATA SHEETS:

datron

TO: THE USER

Every effort has been made to ensure that the information supplied with the instrument is accurate and up to date. If, however, you find any errors or have any suggestions for improving this Manual, please return the reply card completed as appropriate.

Full information is available on the complete range of Datron products and we will be pleased to forward these to you on request by return of the reply card completed as appropriate.

Name:

Dept:

Company:

Address

Instrument:

Serial No:

Manual Ref. No.:

Correction / Suggestion:

Please send information on the following products:--

Model 1030	True RMS Digital Voltmeter	☐
Model 1041	4½ digit Multifunction Digital Voltmeter	☐
Model 1045	4½ digit DC Digital Voltmeter	☐
Model 1051	5½ digit Precision Multifunction Digital Voltmeter	☐
Model 1055	5½ digit DC Digital Voltmeter	☐
Model 1057	5½ digit Digital Multimeter.	☐
Model 1059	5½ digit Digital Multimeter.	☐
Data Logging Equipment		☐

MP MASTER
MA23502